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# The Vulnerability of Zambian Communities Living along the Zambezi River Basin to Floods

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THE VULNERABILITY OF ZAMBIAN COMMUNITIES LIVING  
ALONG THE ZAMBEZI RIVER BASIN TO FLOODS

by

KANMANI VENKATESWARAN

B.S., Kenyon College, 2011

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## Signature Page

This thesis entitled:  
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to Floods  
written by Kanmani Venkateswaran  
has been approved for the Environmental Studies Program

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Dr. Max Boykoff, Environmental Studies

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The final copy of this thesis has been examined by the signatories, and we find that both the content and the form meet acceptable presentation standards of scholarly work in the above mentioned discipline.

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# **Abstract**

Venkateswaran, Kanmani (MSc, Environmental Studies)

The Vulnerability of Zambian Communities Living Along the Zambezi River Basin  
to Floods

Thesis directed by Associate Professor Dr. Max Boykoff

The Zambezi River Basin is highly prone to floods and droughts. In the face of climate change, it will be critically important to address how such hazards become disasters. The Zambezi River Basin Initiative (ZRBI) was launched by the Red Cross in 2009 as a means to help communities cope with risk, by reducing their vulnerabilities and increasing their resilience to natural hazards. In Zambia, four communities – Sikaunzwe, Kasaya, Sikuzu and Situlu – were chosen as pilot sites for the ZRBI. To optimally aid these communities, the nature of vulnerability in the communities needs to be understood. Vulnerability, however, is difficult to measure, especially using standardized methods and indicators. Despite this, the Red Cross uses a standardized tool, vulnerability and capacity assessments (VCA), to measure vulnerability. In this study, I use a selection of VCA tools – baseline survey, hazards maps, focus group discussions, historical data collection – and interviews with Zambia Red Cross disaster management staff in the context of the conceptual frameworks for vulnerability analysis of coupled human-environment systems

(Turner et al, 2003a) and barriers to adaptation (Jones and Boyd, 2010) to assess the vulnerability of communities to floods. I find that communities are vulnerable and unable to successfully adapt to floods largely due to their poverty, poor institutions, and lack of access to knowledge and technology. A major problem, however, is that communities are not involved in the design of the VCA and knowledge is not co-produced. Community exclusion may disincentivize community ownership of the VCA and related initiatives. Furthermore, while VCA data can be used to identify characteristics of vulnerability and identify levels of preparedness, they cannot be used to discern the underlying mechanisms that cause vulnerability. This is largely due to its negligence of the political, historical, and scalar dimensions of vulnerability. Without community engagement and understanding of the mechanisms of vulnerability, the ZRBI will fall short of its goals of reducing vulnerability and increasing resilience in the long-term.

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# CHAPTER I

## Introduction

It is thought that natural hazards will become less predictable and increase in magnitude due to climate change (IPCC, 2007). Consequently, the Red Cross has taken an interest in helping disaster prone communities become less vulnerable and more resilient to climate change and variability. Such a proactive approach is novel engagement for the Red Cross given that they have traditionally responded to natural disasters after they have occurred, distributing emergency relief and providing medical aid, and have not focused much on anticipatory disaster management. The reactive response scheme largely stems from existing funding mechanisms which mandate that funding can only be mobilized once a disaster has occurred and need has been demonstrated.

The effectiveness of reactive responses has recently come under scrutiny within these organizations given that (1) there are difficulties in mobilizing resources rapidly upon the occurrence of a disaster and (2) relief operations do not actually reduce the vulnerabilities of affected populations and enhance their climate resilience (IFRC, 2009; O'Brien et al, 2006). As a result, the Red Cross is working to shift to a more holistic disaster management scheme through the implementation of community-based disaster risk reduction and preparedness activities in vulnerable communities (IFRC, 2009). These measures do not only involve physical risk

reduction and preparedness activities such as erecting floodwater barriers and digging drainages, but also involve socioeconomic vulnerability reduction measures such as crop diversification and alternative livelihoods. The expectation is that increasing individual and community resilience to climate change will reduce the losses and harm caused by natural disasters and reduce the need for emergency humanitarian relief.

The International Federation of the Red Cross (IFRC) and seven National Societies (Angola, Botswana, Malawi, Mozambique, Namibia, Zambia, and Zimbabwe) launched the Zambezi River Basin Initiative (ZRBI) in 2009 as a means to aid hazard-prone communities settled along the Zambezi River. Among the goals of the ZRBI is *disaster preparedness and risk reduction*. Its expected outcomes include: increased individual and community resilience and consequent reduction in vulnerabilities to recurrent disasters, implementation, use of community-based disaster preparedness systems, and increased branch and volunteer capacity for disaster preparedness and risk reduction (IFRC, 2009). With greater capacity on the Red Cross' end and a community-based disaster preparedness system (i.e. early warning > early action) in place, the Red Cross can be the first community-based responders in the event of any climate disaster, small, medium, or large.

A part of the ZRBI requires that National Societies conduct Vulnerability and Capacity Assessments (VCA). The VCA is a participatory research tool which is used to understand existing vulnerabilities and capacities, perceptions of risk and preparedness, and actual preparedness in the target communities. Once

vulnerabilities and capacities are identified, the Red Cross can work with communities to reduce their vulnerability to risks by using existing community capacities (skills, knowledge and initiative) and in turn, prevent hazards from becoming disasters (IFRC, 2007a).

In this study, I first review the literature on vulnerability and identify frameworks that can be used to conceptualize vulnerability and barriers to reducing vulnerability. I also review the concept of ‘useable science’ given that the VCA is intended to be a tool for collecting information that can then be used by the Red Cross to make decisions about community-based disaster risk reduction and preparedness measures. Using the literature review, I identify research questions. Then, I detail the methods used to collect and analyze data. I go on to report and analyze my data and end with a set of conclusions.

## **1.1. Literature Review**

### **1.1.1. Evolution of Vulnerability Research**

While hazards such as floods, droughts, and earthquakes are natural, disasters are not; rather, they are socially constructed (Cannon, 1994; Oliver-Smith, 2004). Disasters result from a combination of natural hazards and the social, economic and political processes and structures of the area in which they occur (Blaikie et al, 1994; Oliver-Smith, 2004). These processes result from power relations in social systems and “generate unequal access to opportunities and unequal exposures to risks” (Cannon, 1994, p. 14). Researchers have largely focused on the concepts of vulnerability, adaptation, resilience, coping capacity, and

adaptive capacity when analyzing the social aspects of disasters, but how they are defined and linked is contested (Gallopín, 2006; Klein et al, 2003; Smit and Wandel, 2006; Adger, 2006; Cutter, 1996; Folke, 2006; Klein et al, 2003). I will limit my literature review to the vulnerability literature given that the VCA focuses specifically on vulnerability.

The concept of vulnerability arose in the 80s when researchers realized that extreme climate events like floods and droughts alone largely did not cause famines. Rather, researchers posited that famines were caused by the absence of individual entitlements (Sen, 1981; Sen 1984). Entitlements are the “set of alternative commodity bundles that a person can command in a society using the totality of rights and opportunities that he or she faces” (Sen, 1984, p. 497). In terms of famines, individual entitlements include the access to food and the ability to trade labour and skills to acquire food (Sen, 1981; Sen, 1984). The problem with Sen’s entitlements-based explanations, however, is that they generally ignore the role of physical exposure to ecological risk in causing crises such as famines (Adger, 2006).

The natural hazards research tradition, on the other hand, theorizes that vulnerability to natural disasters is a function of geography, resource availability and use, and institutions. The risk-hazard (RH) model was developed by natural hazards researchers for the purpose of understanding the impacts of natural hazards in terms of community sensitivity and physical exposure to the hazard (Turner et al, 2003a). RH models showed that the impacts of hazards are highly localized, impacting different communities in different ways (Adger, 2006; Burton et

al, 1993). RH models were however criticized for (1) ignoring how systems themselves exacerbate the impacts of hazards, (2) not providing a deeper analysis of system components that could affect the distribution of hazard impacts in a system, and (3) ignoring the broader political economy's effect on vulnerability and disaster experience (Turner et al, 2003a; Watts, 1983; Cutter, 1996).

Political ecology, therefore, attempts to understand the underlying structural and political causes of vulnerability faced by communities (Adger, 2006). Political ecologists found that marginalized individuals and communities were disproportionately affected by natural hazards and attributed this to “differences in class structure, governance and economic dependency” as mediated by economic development across scales (Adger, 2006, p. 271; Hewitt, 1983). Further analysis of underlying discourses led to the understanding that vulnerability and poverty reduction require capacity, social and institutional organization, learning, and linkages across scales (Eakin and Luers, 2006; Adger et al, 2001).

Given that natural hazards research and political ecology engage with important aspects of vulnerability – sensitivity and exposure in natural hazards research and political economy and human-environment interactions in political ecology – Blaikie et al (1994) merged them in their pressure-and-release (PAR) model. The authors suggested that disasters result from a combination of different pressures, including the natural hazard itself and the progression of vulnerability. PAR explained vulnerability as a progression, where dynamic pressures, i.e. weak institutions, lack of skills and training, population growth, deforestation, etc,

“‘translate’ the effects of root causes” of vulnerability, i.e. underlying power structures, “into the vulnerability of unsafe conditions”(Blaikie et al, 1994, p. 24). These pressures can only be released through disaster management initiatives and the overall reduction of vulnerability (Winchester, 1992; Blaikie et al, 1994). While the PAR model was able to integrate physical and social vulnerabilities into a model, it was deemed too linear and comprehensive to a fault; it could not explain mechanisms of vulnerability or account for the nestedness of system interactions (Adger, 2006; Turner et al, 2003a).

Some of the current research on vulnerability is consequently focused on explaining the mechanisms and processes of vulnerability in social-ecological systems (SES) (Turner et al, 2003a; Turner et al, 2003b; Luers et al, 2003; Luers, 2005; Adger, 2006). An SES integrates social patterns and processes such as culture, institutions, and information with ecological patterns and processes such as primary production, organic matter and disturbance, within a specific political, economic, and biogeophysical context (Redman et al, 2004). These systems are, multi-scalar, dynamic, and adaptive (Redman et al, 2004; Machlis et al, 1997). Turner et al (2003a, 2003b) have studied the linkages and feedbacks that cause vulnerability (defined in terms of exposure, sensitivity, and resilience) within bounded human-environment systems. Part of this requires looking at how external political and environmental forces may shape the vulnerability of the bounded system to hazards. Others have expanded on the Turner et al (2003a) framework in order to make it more methodologically tangible, whilst maintaining its conceptual

base (Eakin and Luers, 2006; Kasperson et al, 2005; Fussel, 2007).

A general consensus that seems to have been reached within vulnerability research, as a whole, is that vulnerability consists of three key parts: exposure, sensitivity, and adaptive capacity/resilience (Adger, 2006; Turner et al, 2003a). Exposure refers to the “nature and degree to which a system experiences environmental or socio-political stress” (Adger, 2006, p. 270). Sensitivity refers to the “degree to which a system is modified or affected by perturbations” (Adger, 2006, p. 270). Adaptive capacity is the “ability of a system to evolve in order to accommodate environmental hazards or policy change and to expand the range of variability with which it can cope” (Adger, 2006, p. 270). Turner et al (2003a), on the other hand, state that the third component of vulnerability is resilience, rather than adaptive capacity. They define resilience as the system’s capacity to cope or respond to perturbations and stresses. Adaptive capacity is, therefore, an element of resilience.

### **1.1.2. Vulnerability Analysis for Sustainability**

One of the most conceptually advanced and useful frameworks of vulnerability is the framework for vulnerability analysis in sustainability science developed by Turner et al (2003a). This framework was developed amidst frustrations that existing vulnerability frameworks (1) were more focused on social vulnerability and largely ignored the vulnerability of biophysical subsystems, (2) were too linear in their conception of exposure as a function of a single stress or perturbation rather than multiple, interacting stresses and/or perturbations, and



(3) did not adequately account for the role of institutions.

Turner et al's (2003a) framework treats systems as coupled human-environment systems in which the human and environmental subsystems interact and influence each other's vulnerability with regards to exposure, sensitivity, and resilience. Exposure consists of the different components of the human-environment system – social units (i.e. individuals, households, communities, etc) and biophysical units (i.e. ecosystems, flora, fauna, etc) – and the characteristics of the stress (i.e the magnitude, frequency, duration, and areal extent of a natural hazard). This framework does not limit the analysis to just one stress; rather, there can be multiple, interacting stresses that the human-environment system is exposed to, i.e. the occurrence of a natural hazard during a period of economic insecurity.

Sensitivity refers to the sensitivity of the coupled human-environment system to an exposure, or a set of exposures. This sensitivity is determined by interacting human and environmental conditions. Turner et al (2003a) define human conditions as social capital and endowments and environmental conditions as natural capital and endowments. Social capital is the “norms and networks that enable people to act collectively” (Woolcock and Narayan, 2000, p. 226). Alternatively, Kasperson et al (2005) refer to human conditions as ‘socioeconomic conditions’ and define it in terms of socioeconomic endowments and entitlements, the range of variability and coping capacity, and the local/regional political economy. Natural capital refers to the ecosystem resources which provide ecosystem goods and services (Turner et al, 2003a).

Both human and environmental conditions affect the coping capacity of the system (Turner et al, 2003a). Marginalized groups tend to be excluded from decision-making and therefore, members of these groups need to depend on their relationships, local institutions, and their resource base, in order to manage their risk and vulnerability (Adger, 2003). Natural capital is important because the social subsystem depends on ecosystem services and goods to cope with exposure and vice versa. In addition, social and biophysical coping mechanisms feed back into each other and affect each other's coping capacities. It is the outcomes of the responses of the social and biophysical systems that determine the resilience of the overall coupled human-environment system (Turner et al, 2003a).

It is important to note that vulnerability occurs in the context of internal and external social and environmental influences. Furthermore, external influences, local influences, and coupled human-environment systems are prone to change, meaning that vulnerability is dynamic (Turner et al, 2003a).

Politics are an important component of these internal and external influences. Adger (2006) states that vulnerability cannot be isolated from the wider political economy. Politics is not adequately considered in the framework. Political conditions can make a system more sensitive to shocks. What is lacking in this framework is a cross-scale arrow between 'sensitivity' and 'human influences outside the place' which would indicate that sensitivity is affected by political interactions across scales. Political ecology can be used here to understand how dominant political discourses affect the environment and development (Pulwarty

and Riebsame, 1997; Adger et al, 2001).

In addition, the historical processes leading to vulnerability are not accounted for. Several studies have found that the underlying causes of vulnerability have to do with the historical processes of community settlement and development and everyday social interactions that occur in the context of the environment and history (Morrow, 1999; Pulwarty and Riebsame, 1997; Hewitt, 1983). Political ecology, through the PAR model, is the only tradition that has successfully incorporated historical context and process into vulnerability research.

A further problem with the framework is its complexity. Eakin and Luers (2006, p. 383) state that “the challenge of undertaking place-based research while incorporating local to global interactions of both social and environmental processes, although increasingly viewed as essential in vulnerability research, is methodologically difficult”. The authors simplify the framework proposed by Turner et al (2003a) in a way that keeps in mind its theoretical elements while making it more tangible methodologically and analytically. The advantage of Eakin and Luers’ (2006) conception of Turner et al’s (2003a) framework goes beyond just its relative simplicity. As I mentioned earlier, the original framework’s treatment of politics is lacking. Eakin and Luers (2006), however, incorporate political ecology into their conception to explore issues of marginalization, differential exposures, differential capacities, and losses and gains.

### **1.1.3. Measuring Vulnerability**

One of the biggest challenges in vulnerability research is measuring vulnerability

(Adger 2006; Turner et al, 2003b; Kasperson, et al, 2005; Hinkel, 2006). What are the determinants of vulnerability? And what indicators should be used to evaluate the determinants of vulnerability?

Vulnerability cannot truly be measured because it is a theoretical concept and “does not denote an observable phenomenon” (Hinkel, 2006, p. 200). Therefore, vulnerability needs to be operationalized, rather than measured. One way of operationalizing vulnerability is through the use of indicators. There are 3 types of indicators: (1) scalar indicators, (2) composite indicators and, (3) vector-valued indicators. All of these indicators represent observable variables which indicate for theoretical variables (Hinkel, 2006). According to Hinkel (2006, p. 201), the development of vulnerability indicators has three steps: (1) “the definition of what is to be indicated”, (2) “selection of indicating variables”, and (3) “aggregation of indicating variables”.

Using indicators, however, comes with numerous issues. First, indicators are representative of a particular variable at a particular spatial and temporal scale. In terms of vulnerability, this is problematic because vulnerability is dynamic with constantly changing drivers (Adger, 2006). What is, therefore, needed are vulnerability indicators which indicate for a possible future state. This involves building predictive models which can predict future states based on changing drivers (Hinkel, 2006). Adger (2006) states that in order to capture vulnerability more accurately, researchers need to look at social processes and material outcomes in systems that are nested, with multiple linkages; however, this is very difficult to

do. Second, while vulnerability frameworks such as Turner et al's (2003a) are available, they tend to be abstract and do not provide much direction in terms of selecting indicators and aggregating indicators. Third, the selection and aggregation of indicators is a subjective process, making it difficult to replicate vulnerability assessments and analysis of the same data set (Hinkel, 2006).

Several studies have focused on generating standardized determinants and indicators of vulnerability and its components (Yohe and Tol, 2002; Brooks et al, 2005; Adger et al, 2004; Cutter et al, 2003). However, indicators change based on place and context (Schroter et al, 2005). A vulnerability assessment conducted in the US cannot use the same socio-economic indicators as a vulnerability assessment conducted in Zambia. Scale is also important when assessing vulnerability, and indicators will change based on the scale studied. National-level indicators of health and wellbeing, for example, do not necessarily reflect the nuances in health and wellbeing at the local levels that affect the capacities of people to adapt (Adger, 2006; Cutter et al, 2003). Therefore, indicators used in studies of large-scale systems cannot be scaled down to assess the vulnerability of smaller-scale systems. Researchers need to select indicators that are relevant to a particular socio-political context and scale (Schroter et al, 2005; Birkmann, 2007).

Despite the difficulties in selecting determinants and indicators of vulnerability and its components, researchers have come up with some generalized determinants and indicators. These determinants and indicators are broad and can be adapted to suit the study. Morrow (1999) finds that community vulnerability

largely occurs due to aggregated household vulnerabilities. These vulnerabilities arise from limited household access to economic, material, human, social, and political resources. Adger and Kelly (2009) and Kelly and Adger (2000) find that the three primary vulnerability indicators are poverty, inequality and institutional adaptation. Poverty is a proxy for marginalization and causes vulnerability by limiting coping capacity, entitlements and empowerment. Inequality is a proxy for collective responsibility, insurance, and social welfare and causes vulnerability via the concentration of entitlements into small sections of the population. Institutional adaptation is a proxy for the architecture of entitlements, internal political institutions that affect adaptation, and aggregated perceptions of vulnerability. Limited or poor institutional adaptation means that institutional structures cannot effectively adapt to changing conditions, thereby leading to vulnerability. These variables all arise from cross-scalar interactions.

Engle and Lemos (2010) provide a comprehensive list of the determinants of adaptive capacity – as determined by IPCC (2001), Pelling and High (2005), Adger (2003); and Yohe and Tol (2002) – that are widely used and referenced in the literature. These determinants include: human capital, information and technology, material resources, social capital, political capital, wealth, institutions and entitlements, equity, and collective action. There is a widespread belief that institutions are the most important determinant of adaptive capacity and that the other determinants are heavily dependent on institutions (Eakin and Lemos, 2006; Brooks et al, 2005; Engle, 2007; Engle and Lemos, 2010; Haddad, 2005; Adger,

2001). Despite this, operationalizing governance and institution-related indicators has been a challenge (Engle and Lemos, 2010).

#### **1.1.4. Assessing Barriers to Adaptation**

Ideally, vulnerable communities will attempt to reduce their vulnerability to shocks through adaptation. Moser and Ekstrom (2010, p. 1) define adaptation as:

“Adaptation involves changes in social-ecological systems in response to actual and expected impacts of climate change in the context of interacting non-climatic changes. Adaptation strategies and actions can range from short-term coping to longer-term, deeper transformations, aim to meet more than climate change goals alone, and may or may not succeed in moderating harm or exploiting beneficial opportunities.”

Adaptation, as defined here fits into the resilience box in the Turner et al (2003a) vulnerability analysis framework given that it is expressed in terms of adaptive and coping capacity.

Adaptation is governed by social processes and institutions (Jones and Boyd, 2011). Successful adaptation strategies, in general, are those that are “sufficiently robust” across “alternative futures” of uncertain climate, economics, politics and culture (Adger et al, 2009, p. 344). Adaptation can be limited by ethics, limited access to precise knowledge, perceptions of climate risk by communities and governments, and undervaluing places and cultures. An adaptive society is therefore defined as having an “awareness of diverse values, appreciation and understanding of specific and variable vulnerabilities to impacts, and acceptance of some loss through change” (Adger et al, 2009, p. 350).

A major element of successful adaptation is collective action. Collective action is especially important in communities that have been marginalized as when

communities are ignored or excluded individuals have to rely on existing relationships, or social capital, within their communities for their own and collective good (Adger, 2003). Strong social networks allow for communities to “confront poverty and vulnerability, resolve disputes, and take advantage of new opportunities” (Woolcock and Narayan, 2000, p. 226). Individuals lacking in social capital, on the other hand, can be excluded from social networks, institutions, decision-making and opportunities, thereby enhancing inequities in the community and negatively impacting the collective good or welfare. Social capital needs to be distributed across the community. (Woolcock and Narayan, 2000).

Social capital, collective action and therefore adaptation are largely mediated by the political and institutional environment (Ostrom, 1994; Woolcock and Narayan, 2000). Institutions can be local or extra-local. Institutions are vital for gathering and circulating information, increasing resource accessibility, capacity building, leadership, and creating connections between communities, decision-makers and institutions (Agrawal, 2010). The capacity of social groups to act in a way that enhances their collective good depends on existing formal institutions (Woolcock and Narayan, 2000). Strong formal institutions and good government are required for local programs to work and communities to thrive. This is especially the case for poor communities who need to reduce their vulnerability and poverty (Skocpol, 1995; Skocpol, 1996). A set of inadequate and ineffective adaptation institutions can therefore enhance the vulnerability of communities to climate change. (Agrawal, 2010).



Institutions and social process that deter social units (people, communities, etc) from adapting are considered 'barriers' to adaptation (Jones and Boyd, 2011; Moser and Ekstrom, 2010). Barriers are obstacles to adaptation that can be overcome, whereas limits are obstacles to adaptation that cannot be overcome (Moser and Ekstrom, 2010).

Moser and Ekstrom (2010) propose a diagnostic framework to identify barriers to climate change adaptation in social-ecological systems. This framework functions on the assumption that actors are rational and emphasizes the importance of context. The framework is scalable and constitutes of three key components – understanding, planning, and managing. The understanding phase constitutes of the following stages: (1) detecting a problem, (2) gathering and using information, and (3) defining or redefining the problem. The stages in the planning phase are: (1) developing options, (2) assessing options, and (3) selecting options. In the managing phase, actors (1) implement options, (2) monitor outcomes and the environment, and (3) evaluate the effectiveness of the different options. Moser and Ekstrom (2010) define the kinds of barriers that there can be in each of the stages that prevent adaptation or encourage maladaptation.

Jones and Boyd (2011) propose an alternative framework in which the key components are (1) social, (2) human and informational, and (3) natural. Social barriers can be normative, cognitive and/institutional. Normative barriers refer to barriers resulting from cultural and historical norms. In some situations, individuals and communities may be unwilling to change their traditional practices.

In addition, normative barriers to adaption arise from persistent historical social structures (i.e. caste-based vocation) that exacerbate the vulnerability of particular individuals and groups to climate shocks (Jones and Boyd, 2011).

Cognitive barriers are psychological processes that limit or prevent individual action in the face of hazards (Jones and Boyd, 2011). Grothmann and Patt (2005) show that perceptions of climate risk (probability of risk and severity of risk), especially a perceived lack of coping capacity, can result in ‘avoidant maladaptation’, i.e. denial, fatalism, and wishful thinking. In addition, it has been shown that individuals are resistant to taking actions that may result in loss, even if the potential benefits are high (Baron and Ritov, 2004). Individual perception of coping capacity combined with the costs of coping is referred to as ‘coping appraisal’ (Grothmann and Patt, 2005; Grothmann and Reusswig, 2006).

Institutional barriers arise when the structure of formal and informal interactions influence individual response to change and variability (Jones and Boyd, 2011). This is in line with the idea that institutions structure “incentives for individual and collective action” (Agrawal, 2010, p. 8). Incentives, in turn, determine the patterns of interactions that lead to particular outcomes (i.e. adapting or not adapting to a hazard). Weak institutions can lead to perverse incentives and informational and power asymmetries between different actors and motivational issues, and overall inhibit collective action (Andersson et al, 2005).

A missing type of social barrier in the Jones and Boyd (2011) framework is political barriers. While institutional barriers can be considered a type of political

barrier, they do not necessarily account for historical and current political processes and decisions that affect how people respond to change and variability.

Human and informational barriers can be knowledge, technology, and/or economics-oriented. Knowledge barriers arise when individuals and communities do not have access to climate knowledge (i.e. through forecasts) and do not know how to interpret and use the knowledge they receive. Patt and Gwata (2002) outline situations in which communities may hesitate to use scientific climate forecasts. Forecasts will not be used if users do not think they are credible, legitimate, or if they will clash with traditional modes of forecasting. In addition, forecasts will either not be used or will be used incorrectly if the forecast is communicated in inaccessible, difficult, and confusing language. Forecasts are also not necessarily used when the spatial and/or temporal scales of the forecasts are too large. Conversely, access to knowledge can also be a barrier to adaptation. In Zimbabwe and Brazil, for example, banks have taken advantage of the greater access to climate forecasts, denying credit to high-risk farmers when forecasts indicate poor rains, thereby reducing the adaptive capacity of the farming communities (Hammer et al, 2001; Lemos et al, 2002).

Technological barriers arise when communities lack access to technologies that may help them adapt to risks or when technologies actually cause maladaptation. Smit and Pilifosova (2003) describe how access to snowmobiles, motorized boars and sonar have allowed Inuit communities to reside in one place.

This sense of permanence will make it difficult for Inuits to retreat or migrate during sea-level rise, thereby increasing the vulnerability to sea-level rise.

Economic barriers arise when individuals and communities do not feel that they have the adequate economic resources to effectively adapt to climate change and variability. Adaptation strategies require some input, be it resources or time. In the face of low income, limited assets and “limited capital mobility and lack of alternative livelihoods”, community members seem to resort to short-term strategies which is focused on meeting their and their household’s daily needs – “they prefer profits and food now over a continual flow in perpetuity” (Pomeroy et al 2006, 788).

Finally, the natural barriers/limits consist of physical features (i.e. topography, hydrology, soil porosity) or ecological features and processes (i.e. fires) that may prevent communities from adapting to risk. More often than not, these are limits rather than barriers because they are difficult for people to change. Instead, people have to cope with them or change their behaviors and/or plan with those limits in mind.

#### **1.1.5. Usable Science**

For the Red Cross, the purpose of the VCA is to produce knowledge, or ‘usable science’, with which informed decisions about potential disaster risk reduction and preparedness initiatives can be made. Lemos and Morehouse (2005, p. 61) state that usable science “refers to the degree that the science produced through the integrated assessment process results in knowledge that meets constituent needs”.

The VCA's utility as a tool to effectively measure household and community vulnerabilities and capacities needs to be assessed. In this section, I will be reviewing what constitutes as 'usable' science for decision-making and how science can be made more usable.

There are two ways in which knowledge is commonly produced: the *Science Push* and the *Demand Pull*. The *Science Push* is where knowledge production is driven by the "pursuit of knowledge", rather than the need for solutions (Dilling and Lemos, 2011, p. 682). Scientists set the information agenda. Therefore, scientists assume what information stakeholders need and therefore determine among themselves what knowledge is to be produced (Dilling and Lemos, 2011). The *Demand Pull* is where stakeholders set the information agenda and determine what information they need from scientists.

The linearity of the *Science Push* and the *Demand Pull* is problematic. For one, it may be that knowledge users and knowledge producers perceive their needs differently. The *Science Push* privileges the needs of the knowledge producers and the *Demand Pull* privileges the needs of the knowledge users. In the *Demand Pull*, the knowledge demanded may be difficult for scientists to produce (Dilling and Lemos, 2011; Sarewitz and Pielke, 2007). Two, neither of the models take into consideration the range of perceptions of need and information usability that exist within knowledge producer and user communities (Lemos and Rood 2010). Three, risk is not universally perceived. Rather, there are "distinct cultures of risk" which are socially, culturally and politically influenced (Robbins et al 2010, p. 85). A user

community is not merely one stakeholder group with a shared set of values and needs. Four, there are also different values and needs within one aggregated stakeholder group (Archer, 2003). Phadke (2011), for example, in her case-study of the social movement surrounding the Chikotra river dam project, demonstrates that the 'local' does not constitute of one body of knowledge; the 'local' includes project beneficiaries and project-affected peoples (PAPs), and within the PAPs, there are a multiplicity of knowledges and lived experiences based on geographical location, socio-economic status, agricultural practice, and so on. Dilling and Lemos (2011) contend that there is also variation within the producer community. In this sense, the knowledge produced does not represent a universal truth, thereby limiting its utility in particular contexts (Forsyth, 2003). While boundaries are drawn between knowledge producer and user groups as a means to establish order, it is important to understand that within aggregate stakeholder groups, there exists a range of values, beliefs, and perceptions based on lived experiences and worldviews (Forsyth 2003; Adger et al 2009).

Knowledge, therefore, needs to be co-produced between producers and users. The concept of co-production recognizes that there is "a world of sciences" which are partial, imperfect, and situated in their local contexts (Harding 2011; Haraway 1988). Jasanoff (2004) claims that co-production of knowledge will produce better and more comprehensive descriptions of natural and social phenomena, improve the explanatory power of social science theories, and force us to be critical of the ways in which societies constitute and reconstitute themselves based on their changing

perceptions of nature. In addition, co-production will allow knowledge producers to become aware of users' needs and users of producers' capabilities, resulting in knowledge that is credible, salient and legitimate (Dilling and Lemos, 2011; Cash et al, 2006). This also means that the process of knowledge production will be sensitive to changing and differential perceptions of risk within stakeholder communities.

Dilling and Lemos (2011) contend that iteration between producers and users is a way of ensuring that knowledge is co-produced and consequently more tailored to the needs of users. Iteration is a form of mediation and/or translation. The aim of translation is to create hybrid knowledges between new beings, social groups, and/or nature and culture and requires cross-scalar interactions to occur between the different knowledge producer and user communities (Latour, 1993; Jasanoff and Martello, 2004).

Dilling and Lemos (2011) suggest several mechanisms by which iteration, or mediation and/or translation, can take place. First, *information brokers* can be used as intermediaries between knowledge producers and users given that they are well-versed in both worlds. Second, *collaborative group processes* can be encouraged in situations where decision-making is dispersed and significantly affects a large number of stakeholder groups. Third, *embedded capacity* is when the internal capacity of an organization (i.e. human resources, leadership and technical capacity) is improved to incorporate scientific knowledge into decision-making. Fourth, *boundary organizations* are like information brokers, but have greater

organizational capacity and resources to “tailor information and produce value-added products” (Dilling and Lemos, 2011, p. 686). Finally, *knowledge networks* are informal and flexible networks comprised of the different stakeholder groups. These networks provide stakeholder groups a platform over which to communicate, share information, collaborate and make decisions.

Knowledge networks have received particular interest. This is due to the following reasons: (1) the informality of knowledge networks means that there can be a flux of stakeholder groups based on who has stakes given a specific forecast, (2) there is recognition that knowledge producer and user communities are bound by institutional constraints, (3) the constant iteration and reiteration between different stakeholders builds trust and overcomes issues of knowledge credibility and legitimacy, and (4) collaboration and mutual learning allows for adaptive climate governance (Dilling and Lemos, 2009; Feldman and Ingram, 2009). However, Feldman and Ingram’s (2009, p. 10) conception of a knowledge network is problematic:

“[Knowledge networks] are composed of policy makers, scientists, government agencies, and nongovernmental organization linked together in an effort to provide close, ongoing, and nearly continuous communication and information dissemination among multiple sectors of society involved in technological and policy innovations for managing climate impacts”.

Where are the vulnerable communities within this network? It is unclear if the nongovernmental organizations act as boundary spanners, linking local communities with decision-makers. The exclusion of vulnerable communities from knowledge networks further disenfranchises them. If knowledge is to be



successfully co-produced and result in locally relevant, legitimate and credible forecasts, vulnerable communities need to be included in the knowledge network.

How are knowledge networks created and established? Knowledge networks are created when a need arises to collate the goals, convergent or divergent, of organizations and social groups involved in a particular decision-making context. The most effective knowledge networks are those that “promote broad, user-driven management objectives” (Feldman and Ingram 2009, p. 13). These networks place great emphasis on mutual learning, a dynamic and iterative process between knowledge producers and users. Knowledge-action systems need to be flexible to allow for the production, use and circulation of knowledge, self-innovation, and response to changing conditions.

At the core of networks and their interactions are institutions (Jasanoff and Martello 2004). There need to be institutions that enhance the efficiency and effectiveness of and establish order within a network of interactions. Knowledge networks can be institutionalized through boundary organizations (Feldman and Ingram 2009). The advantage of boundary organizations is that they recognize that knowledge producer and user communities are bound by institutional constraints and their own social context, and therefore allow for these communities to maintain their epistemic authority. The network can, therefore, function on the basis of a *modus operandi* rather than a shared consensus, which is difficult and often impractical to reach (Star and Griesemer 1989).

## 1.2. Research Questions

The Red Cross' aim with regards to anticipatory disaster management is to reduce the vulnerability and increase the resilience of communities to natural hazards. They use the VCA to identify vulnerabilities that they need to focus on. However, identifying vulnerabilities alone is not enough. It is important to determine the barriers that impede the ability of communities to adapt to climate change and variability. By focusing on mitigating these barriers, the Red Cross can fundamentally reduce the vulnerabilities faced by these communities to natural hazards in the long-term. The literature, however, shows that vulnerability is difficult to measure and that the determinants of community sensitivity and adaptive capacity change based on context. This brings into question the VCA's utility as a standardized toolkit for understanding vulnerability and hence, the potential success of the Red Cross' anticipatory disaster management initiative.

In my study, I first aim to understand why Zambian communities living in the Zambezi River Basin are vulnerable to floods. I use Turner et al's (2003a) framework for vulnerability analysis in sustainability science to assess vulnerability. Then, I identify whether or not communities have been adapting to floods. If they have not been adequately adapting to floods, I discern the barriers to adaptation using the Jones and Boyd (2011) framework. Finally, I use both frameworks to critique the VCA process and determine whether or not it is able to evaluate vulnerability and provide a basis for developing community-based risk reduction and preparedness activities.

In summary, my research questions are:

1. Why are Zambian communities living in the Zambezi River Basin vulnerable to floods?
2. Are communities adequately adapting to floods? If not, what are the barriers to adaptation?
3. Is the VCA really a useful tool for evaluating vulnerability and making decisions to reduce community vulnerability and increase community resilience to floods?

## CHAPTER II

### **Methods**

The data I use in this study were collected as a part of VCAs conducted for the ZRBI. I also use data collected from interviews with Zambia Red Cross (ZRC) disaster management staff. Data collection was conducted between June 1, 2013 and July 10, 2013 in Kasaya, Sikaunzwe, Situlu and Sikuzu, all communities located in the Zambezi River Basin. These communities were chosen by the ZRC as pilot communities for the ZRBI.

#### **2.1. Vulnerability and Capacity Assessment**

I conducted vulnerability and capacity assessments (VCAs) in Sesheke and Kazungula as per IFRC protocol (IFRC 2007a; IFRC 2007b; IFRC 2008b). I conducted the following methods which were all in the Red Cross VCA Toolkit and were all designed and conducted based on Red Cross VCA protocol (IFRC, 2007a; IFRC, 2007b; IFRC, 2008): (1) baseline survey, (2) historical data questionnaire, (3) focus group discussion, (4) hazards mapping, and (5) transect walk. I additionally interviewed ZRC disaster management staff. For this study, I will not be using the data from the transect walks because they provide information already contained in the hazard maps. Before I started my data collection, I organized meetings with community leaders from each of the four communities. The purpose of these meetings was to inform community leaders of the ZRBI, Red Cross goals, and the

research agenda, and to also gain their support and consent for conducting our research in their communities. Community leaders have a great deal of influence in their communities and command a lot of respect. Their endorsement meant that community members would be more likely to cooperate and participate in our activities.

### **2.1.1. Baseline Survey**

The baseline survey is a household-level close-structured survey and was used to collect basic information about physical and socio-economic vulnerabilities and household perceptions of disasters and disaster preparedness (Appendix 6). Households were chosen using a systematic sampling method where I walked through the community and surveyed every tenth household. Therefore, the amount of surveys is proportional to the number of households in the community (Table 1). If household members were not present in a selected household, I continued surveying and returned to the same household at a later stage in the day or week. If none of the household members were present in the house after a maximum of three returns, I surveyed the neighboring household. I obtained informed verbal consent from households before they were surveyed. If a household refused to be surveyed, I went to the neighboring household and continued surveying. All baseline survey respondents were over the age of 18. Names and other identifiable information (other than community and village name) were not recorded. In addition, I had a Red Cross translator with me to translate the survey questions, which were written

in English, and the responses. The data were collated on Excel and analyzed using Stata.

	Kasaya	Sikaunzwe	Sikuzu	Situlu
No. HH	30	59	10	23

**Table 1. Number of households surveyed for baseline survey.**

### **2.1.2. Historical Data Collection**

The historical data collection consisted of semi-structured questionnaires, used to collate local knowledge on climate hazards, create a timeline of hazards experienced by communities, and understand how floods with different magnitudes manifest in the local context (Appendix 2). I collected data about historical disasters (primarily floods and droughts), their consequences, and how *communities*, as a whole, responded to them. I used the snowball method of surveying where I first surveyed the community leaders and then surveyed those recommended by community leaders as knowledgeable about historical events (i.e. the elderly). I obtained informed verbal consent from the interviewees before proceeding with the questionnaires. All historical data respondents were over the age of 18. Names and other identifiable information (other than community and village name) were not recorded. In addition, I had a Red Cross translator with me to translate the survey questions, which were written in English, and the responses. The data were collated on Excel.

### **2.1.3. Focus Group Discussions**

During the data collection period, I conducted focus group discussions in each of the communities. These discussions consisted of community meetings – both men

and women participated – and were focused on understanding community perceptions of risk and preparedness, community responses to floods, the involvement of external agencies (NGOs, government, civil society organizations, etc) in the communities, and the potential for disaster risk reduction and preparedness initiatives such as early warning systems. There was a pre-prepared list of questions to guide the discussion, however, the discussions were open and tended towards the questions and subjects important to community members (Appendix 0). I facilitated the discussion with the help of the Red Cross disaster management team and a Red Cross translator. The group discussion was video-recorded and meeting minutes were taken; participants were told that the recordings would only be used for research purposes. I transcribed the focus group discussions and coded the transcriptions using NVivo (codebook can be found in Appendix 5).

#### **2.1.4. Hazards Mapping**

The focus group discussions ended with a hazards mapping session in which community members were divided into groups and asked to draw maps of their communities using pen and paper. On the maps, they indicated areas of flood risk (i.e. vulnerable households, vulnerable fields, submergence zones) and locations of local capacities (i.e. clinics, upper lands, possible shelters). The groups were given approximately thirty minutes to produce the maps. The groups then presented their maps. In Sikaunzwe and Kasaya, groups were divided based on which zone they lived in. Therefore, for both communities, there are maps for each of the zones. In

Situlu and Sikuzu, community members drew maps of the full community – the most informative maps were chosen from each of the communities for the purposes of analysis.

## **2.2. Interviews**

I conducted three semi-structured interviews with Zambian Red Cross staff involved in disaster management. The questions asked concerned past experiences with disaster management, the Red Cross' capacity to manage climate disasters, the Red Cross' decision-making structure, their relationship and interactions with external organizations, and how they felt the Red Cross' capacity could be improved (Appendix 14). I obtained informed verbal consent from the interviews before proceeding with the interview. The interviews were conducted anonymously and in English. The interviews were audio-recorded and transcribed. These transcriptions were not coded because they were used primarily to gauge organizational and decision-making structure and relief distribution processes in the Red Cross.

## **2.3. Data analysis**

### **2.3.1. Vulnerability of Communities**

#### **2.3.1.1. Definition of the human-environment system**

My analysis of community vulnerability to floods is conceptually informed by the Turner et al (2003a) framework for vulnerability analysis and the components of vulnerability assessments as described by Luers and Eakin (2006). Therefore, I first define the coupled human-environment system by identifying and describing



the communities and their location and I also briefly describe the physical/ecological characteristics of the environment. I proceed to explain my focus on floods and base it on people's past experiences with floods using data from the baseline survey, historical data collection and focus group discussions. I then define the desired state of the human-environment system as defined in the focus-group discussions. To do this, I code my focus-group data transcriptions to find what future is valued in each of the communities – what goals, desires and hopes do individuals express for their communities? I incorporate Red Cross ZRBI goals in order to further define the futures valued in these communities given that these communities will need the resources provided by and available to the ZRC in order to successfully reduce their vulnerabilities.

#### 2.3.1.2. Exposure

I go on to describe the exposure of the communities to floods. I determine the change in flood frequency using the historical data. I count the number of floods reported in each decade since the 1950s for each community and determine household-level perceptions about change in disaster frequency using the baseline survey. I then determine the magnitudes of floods by using the water levels reported by individuals in the historical data as a proxy for severity – floods with higher water levels are considered more severe. I also use the flood impact data provided by individuals in the historical data to gauge flood severity. Next, I determine the duration of floods. While I do not have information on how long flood waters persist, the historical data does, to some degree, indicate the impacts of

floods, many of which have long-term effects. Finally, I describe the areal extents of floods in each community using the hazards maps drawn by community members and the notes that I took while they were presenting their maps.

#### 2.3.1.3. Sensitivity

After determining community exposure to floods, I evaluate community sensitivity to floods. Kaspersen et al (2005) contend that the human conditions that make social units (individuals, communities, regions) vulnerable to floods are primarily socio-economic in nature and include socioeconomic endowments and entitlements, the range of variability and coping capacity, and the local/regional political economy. I use data from the baseline survey and focus group discussions to gauge how wealth, education, secondary livelihood, agricultural dependency, household construction quality, water accessibility, gender and age effect household and community sensitivity to floods. I utilize household-level data based on the assumption that community vulnerability to disasters is partly based on aggregated household-level vulnerabilities (Morrow, 1999; Moore et al, 2004 ).

I use the baseline survey to test hypotheses of sensitivity at the household-level (Table 2). To test these hypotheses, I merge my data for all four communities, under the assumption that all four communities are similar socially, culturally, and economically. Households are identified as being sensitive if they indicated in the baseline survey that: (1) house has been flooded in the past, (2) crops have been lost due to floods in the past, and (3) household has suffered losses due to floods in the past. In Stata, household sensitivity, the dependent variable, was treated as ordinal

data where sensitive households were coded as ‘1’ and not sensitive households were coded as ‘0’.

<b>Hypothesis</b>	<b>Statistical test</b>
Wealth is associated with sensitivity to floods	Kruskal-Wallis
Educational attainment is associated with sensitivity to floods	Kruskal-Wallis
Having a secondary livelihood is associated with sensitivity to floods	Wilcoxon-Mann Whitney
Agricultural dependency is associated with sensitivity to floods	Wilcoxon-Mann Whitney
Household construction quality is associated with sensitivity to floods	Kruskal-Wallis
Distance to primary water source is associated with sensitivity to floods	Simple logit regression
Gender is associated with sensitivity to floods	Wilcoxon-Mann Whitney

**Table 2. Summary of statistical tests conducted to gauge associations between socio-economic endowments and household sensitivity to floods.**

I test the association of wealth and household sensitivity using the Kruskal-Wallis test. Given that the income data collected was poor, I create a wealth index using baseline survey data. In this index, I award households points for meeting certain conditions (Table 3). A higher score indicates greater wealth, where the highest possible score is 31. It is important to note that this wealth index only provides a partial explanation of wealth in the communities in question. The conditions chosen represent the best indications of wealth in the baseline survey, based on community beliefs as to what constitutes as wealth. In addition, the points for the different conditions are not weighted based on their relative values. I also code my focus group transcriptions to see if there are any indications of the effect of wealth on flood sensitivity.

	<b>Points awarded</b>			
<b>Condition</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>
Does the HH have a primary occupation?	No	Yes	-	-

Does the HH have a secondary occupation?	No	Yes	-	-
Does the HH have electricity?	No	Yes	-	-
Does the HH have piper water?	No	Yes	-	-
Does the HH own a pit latrine?	No	Yes	-	-
Does the HH have a radio?	No	Yes	-	-
Does the HH have a TV?	No	Yes	-	-
Does the HH have a clock/watch?	No	Yes	-	-
Does the HH have an axe?	No	Yes	-	-
Does the HH have a mobile phone?	No	Yes	-	-
Does the HH have a sewing machine?	No	Yes	-	-
Does the HH own jewelry?	No	Yes	-	-
What type of transport does the HH have?	None	Bicycle	Motorbike	Car
Does the HH have a refrigerator?	No	Yes	-	-
How many chickens/turkeys/ducks does the HH own?*	0	1 to 15	16 to 30	30+
How many cows does the HH own?*	0	1 to 5	6 to 10	11+
How many pigs does the HH own?*	0	1 to 5	6 to 10	11+
How many goats/sheep does the HH own?*	0	1 to 5	6 to 10	11+
What is the house floor made of?	mud	tiles, mud with DPC, or cement/bricks	-	-
What is the house's outer wall made of?	mud	cement, burnt bricks, or lumber/board	-	-
What is the house's roof made of?	grass thatching	tarpaulin, cement/slate, or iron sheets	-	-

**Table 3. Wealth index for baseline survey. \*The point system for domestic animal ownership was subjectively decided by using median, 25% quartile, 75% quartile, minimum and maximum values.**

I test education as an indicator of sensitivity based on the rationale that more educated households suffer less losses from disasters as they are able to make better decisions with regards to household construction and location and overall preparedness (Toya and Skidmore, 2007). I use the Kruskal Wallis test to test the

association of educational attainment and household sensitivity. Here, I use the educational attainment of the household's most educated member and I categorize the data using the following designations: college degree, upper secondary graduate (12<sup>th</sup> grade), some upper secondary (grades 10-11), junior secondary graduate (grade 9), some junior secondary (grade 8), primary graduate (grade 7), some primary (grades 1-6), and no education. I also code my focus group transcriptions to see if there are any indications of the effect of education on flood sensitivity.

I then focus on how having or not having a secondary livelihood impacts flood sensitivity. The rationale for this hypothesis is that households without multiple livelihood strategies are more prone negative stresses or sudden changes (Ellis, 2000; Pomeroy, et al 2006). I use the Wilcoxon-Mann Whitney test to test if flood sensitivity is associated with having or not having a secondary livelihood. I also code my focus group transcriptions to see if there are any indications of the effect of livelihoods on flood sensitivity.

I go on to look at the effect of dependence on agriculture (arable and livestock) on flood sensitivity. Flooding is very damaging to arable farming as floodwaters can damage farm land, wash crops away, cause soil erosion, and waterlog fields. Flooding is also damaging to livestock farming because floodwaters can damage grazing fields and livestock shelters (Posthumus et al, 2009). I conduct a Wilcoxon-Mann Whitney test to test if flood sensitivity is associated with agricultural dependence, where households are considered dependent on agriculture if agriculture is their main source of income. I also code my focus group

transcriptions to see if there are any indications of how agricultural dependency has affected vulnerability in the face of floods.

Next, I test the association between flood sensitivity and household construction quality using a Kruskal Wallis test. The quality of house variable is based on an index I create where I award one point for each of the following conditions: (1) house floor is made of tiles, mud with DPC, or cement/bricks, (2) house outer wall is made of cement, burnt bricks, or lumber/board, and (3) house roof is made of tarpaulin, cement/slate, or iron sheets. The poorest quality house has mud flooring, mud outer walls and a thatched roof and will have an index score of 0. I also code my focus group transcriptions to see if there are any indications of how houses and community infrastructure have been affected by floods.

I then look at how water availability effects household and community sensitivity to floods. Schipper (2009) states that water availability affects societies' susceptibility to disasters. Potable water sources can be contaminated during floods and can therefore prevent people from recovering from disasters (IPCC, 2012; Braman et al, 2010). To test the association between water availability and flood sensitivity, I conduct a simple logit regression, where distance to the nearest water source is a proxy for water availability. I also code my focus group transcriptions for indications of the effect of water availability on flood sensitivity.

I proceed to determine who are the most vulnerable groups in the community. The most vulnerable groups are the most sensitive and will have the least capacity to respond to floods. I focus on age and gender. I do not focus on ethnicity given

that the individuals from all 4 communities are Lozi. I use the baseline survey data and the Wilcoxon-Mann Whitney test to test the association between gender and flood sensitivity. I do not use baseline survey data to test the association between respondent age and flood sensitivity because individuals below the age of 18 were not interviewed for the baseline survey. I code my focus group transcriptions for indications of particularly vulnerable groups, particularly by age and gender, in the communities.

Another important social component of sensitivity is social capital. Social capital refers to the relationships within a society. The idea is that those with greater social capital are less susceptible to disasters because they have networks of trust and reciprocity that they can count on during a crisis (Woolcock and Narayan, 2000). In addition, it is thought that greater social capital makes access to social goods easier (Pelling and High, 2005). Social capital is difficult to measure and accordingly, the baseline survey does not directly measure components of social capital like trust and reciprocity. I base my assessment of social capital on the roles of individuals (i.e. village headmen, community leaders, community members), the structure of communities and villages, and the structure of households and families. I code my focus group transcriptions to determine the roles of these different social actors. In addition, I test the association between number of household members and flood sensitivity using a simple logit regression. The rationale here is that households with more people have larger social networks that they can rely on during a crisis. To test this hypothesis, I conduct a two-way chi-square test to test if

differential sensitivities to floods are associated with the number of household members.

According to Turner et al's (2003a) framework, system sensitivity to shocks also depends on environmental ecological conditions, or biophysical/ecological endowments. I, therefore, code my focus group transcriptions to determine what ecosystem services and goods the biophysical subsystem provides the social subsystem with. I also utilize the hazards maps and my personal observations. The baseline survey does not provide any data on the physical subsystem.

Finally, I also determine how community sensitivity to floods has been affected by previous shocks, primarily floods and droughts (Schipper, 2009). I first collate the historical data on the impacts of previous natural disasters and determine whether or not any of these impacts could have long-term implications (based on the literature). Second, I code the focus group transcriptions for indications of the long-term effects of floods and droughts and how they have affected their sensitivity to floods.

#### 2.3.1.4. Resilience/Adaptive Capacity

Community sensitivity to floods is largely dependent on resilience or adaptive capacity (Turner et al, 2003a; Adger, 2006). Adaptive capacity constitutes of shorter term coping capacity and longer term adaptive capacity (Turner et al, 2003a). Coping capacity has to do with the ability of a community to cope with disasters and adaptive capacity has to do with the ability of communities to adapt to change and variability over the long term and become less susceptible to future shocks (Smit



and Wandel, 2006). A form of adaptation is preparing for future disasters. First, I gauge how communities have responded to, or coped with, floods in the past. A lack of response indicates low coping capacity. I use the historical data to determine how the communities have responded to floods in the past and the success of these responses. In addition, I code the focus group transcriptions for statements/indications of how communities have responded to floods in the past and how they respond now.

I then determine whether or not greater preparedness means less sensitivity to floods. I use the following baseline survey question as a proxy for household preparedness: Have family members spoken about/planned what to do if a disaster occurs? I conduct a Kruskal-Wallis test to test if flood sensitivity is associated with household preparedness.

I proceed to gauge how prepared communities are to respond to floods I first use the baseline survey to determine community preparedness based on the following questions: (1) Does the community have a committee/organized group that decides what to do during disasters, (2) Does the community have a disaster plan, (3) Does the community have an early warning system? (4) Does the community have evacuation routes? (5) Does the community have a shelter identified where people can go in the event of a disaster? (6) Have community members been trained to assist others in the event of a disaster? Then, I code the focus group transcriptions for indications of community preparedness and capacity to deal with

floods. In the next section, I explain the state of community adaptive capacity to floods.

### **2.3.2. Barriers to Adaptation**

According to the literature, the determinants of adaptive capacity include human capital, information and technology, material resources, social capital, political capital, wealth, institutions and entitlements, equity, and collective action (Engle and Lemos, 2010; IPCC, 2001; Pelling and High, 2005; Adger, 2003; Yohe and Tol, 2002). A lack of any of these things creates a barrier to adaption and adversely affects the coping and adaptive capacities of communities to floods. Consequently, I utilize the Jones and Boyd (2011) framework for assessing barriers to adaptation. The authors contend that there are three types of barriers to adaption: (1) social, (2) human and informational, and (3) natural.

Before I delve into the barriers to adaptation, I gauge the association between perceptions of risk and preparedness at the household level to determine the extent to which perceptions of risk have affected preparedness. I conduct a series of chi-square tests to test the association of whether or not households have spoken about disasters (a proxy for actual preparedness) with: (1) household concern for natural disasters, (2) perceptions of change in disaster frequency, and (3) household belief that a disaster will/will not occur in the next 5 years. If these associations are not significant, then it can be concluded that there are other barriers that prevent households and communities from preparing for disasters.

#### 2.3.2.1. Social Barriers

Social barriers to adaptation can be normative, cognitive and/or institutional (Jones and Boyd, 2011). In order to determine the normative barriers that exist in the communities, I code my focus group transcriptions for the following questions: (1) What are ‘traditional’ practices in the communities? (2) How are these practices affected by floods? (3) How do these practices exacerbate the effects of floods? (4) Why have these practices not been modified/discontinued?

To determine the cognitive barriers that exist in the communities, I determine perceptions of climate risk and perceptions of preparedness. I code my focus group discussions for perceptions of risk and preparedness, and also for indication of fatalism, denial, and/or wishful thinking (Grothmann and Patt, 2005). In addition, I utilize my baseline survey data to determine perceptions of preparedness. I focus on the following questions: (1) Will being prepared help your family in an emergency situation? (2) How prepared is your family to handle a disaster? (3) Compared to last year, is your family more or less able to handle a disaster? If less able, why? (4) Does your family have supplies/other things in the home that can be used in the case of a disaster?. I test the associations between perceptions of preparedness with their actual preparedness (Have family members spoken about/planned what to do if a disaster occurs?) using a series of two-way chi-square tests.

I then determine the political barriers to adaptation, an important type of social barrier that is excluded from the Jones and Boyd (2011) framework. I code my

focus group discussions for indications of political barriers. I also look at documents and reports of the political history of the Southern and Western provinces in Zambia and identify political factors that may have influenced adaptive capacity in the 4 communities.

I then determine institutional barriers to adaptation. First, I consider what formal interactions influence community response to change and variability. In order to do this, I identify the primary actors/agencies involved in disaster response (community, ZRC, and Zambian Government) and determine the interactions between each of them. I utilize my interview transcriptions with ZRC disaster management staff to determine how communities interact with the Red Cross and how the Red Cross interacts with the Government. I utilize my focus group transcriptions and disaster policy documents to determine how the Government and communities interact with each other. I also use the following questions from the baseline survey: (1) Has the government been involved in any projects/activities related to reducing disaster risk or vulnerability in the past? (2) Are community members involved in planning/coordinating with the local government? Second, I identify the informal interactions that influence community response to change and variability. I code my focus group transcriptions for indications on the role of households, individuals and the traditional leadership in disaster management. Finally, I determine the incentives that these institutional barriers give rise to at the operational and collective-choice levels (based on Andersson et al, 2005).

#### 2.3.2.2. Human/Informational Barriers

There are three types of human/informational barriers: (1) knowledge, (2) technology, and (3) economics. I first identify the knowledge barriers that exist in the communities. I determine the kinds of knowledge that communities need to help them better respond to floods and/or adapt to climate change using the literature – this includes forecasts, knowledge on how to interpret forecasts, and knowledge on how to better prepare for floods (Suarez and Tall, 2010; Patt and Gwata, 2002). I code the focus group discussions for indications of the kinds of knowledge/information community members think they need, their access to that knowledge, their use of that knowledge, and the involvement of external organizations/agencies in promoting preparedness. I utilize the baseline survey. I first count the number of people who have received forecasts in the past and then conduct a chi-square test to determine whether forecast availability determines forecast use. I also establish if communities have knowledge about preparedness. I look at the assets that households may have (radio, mobile phone, bicycle, axe, car, and motorbike) and determine whether they perceive these assets to be supplies they can use in case of a disaster.

Furthermore, I look at the following questions to determine preparedness sensitization conducted by external organizations/agencies: (1) Have any family members attended a meeting on how to be better prepared for a disaster in the past year? (2) Have any family members attended a First Aid training in the past year? (3) Have any family members participated in a disaster/evacuation drill in the past year? (4) Have any family members participated in a community/volunteer activity

related to disaster preparedness/prevention? (5) Has a person visited your home to talk about disasters in the last 6 months? (6) Have you received a pamphlet/flier about disasters in the last 6 months? (7) Have you received information on disasters from television, radio, internet, newspaper or other media sources in the last 6 months? (8) Has the government been involved in any projects/activities related to reducing disaster risk or vulnerability in the past year? (8) Can community access government resources/programs for disaster response and/or recovery?. I conduct a series of two-way chi-square tests to determine the association of external agency involvement with disaster preparedness, where preparedness is indicated by the question: Have family members spoken about/planned what to do if a disaster occurs?

I also look at household consistency in answering the following questions about their community: (1) Does the community have a committee/organized group that decides what to do during disasters, (2) Does the community have a disaster plan, (3) Does the community have an early warning system? (4) Does the community have evacuation routes? (5) Does the community have a shelter identified where people can go in the event of a disaster? (6) Have community members been trained to assist others in the event of a disaster? (7) Are community members involved in planning/coordinating with the local government? Inconsistencies in response indicate information barriers within the communities.

I proceed to determine the technological barriers to adaptation in the communities. I code the focus group transcriptions to indicate the following: (1)

What kind of technology do communities need to help them better respond to floods/adapt to climate change? (2) Do they have access to this technology? (3) Do they use the technology that is available?

Finally, I consider the economic barriers to adaptation in the communities. I code the focus group transcriptions to indicate the following: (1) What economic resources/assets do communities need to respond to floods? (2) What economic resources/assets do communities have access to? (3) Do they use their economic resources/assets for the purposes of disaster risk reduction and preparedness?

#### **2.3.2.3. Natural/Physical Barriers/Limits**

I code my focus group discussions for any indications of how physical and natural characteristics and processes inhibit adaptation to floods.

#### **2.3.3. Utility of the VCA**

This section is primarily a reflections section, detailing my experience conducting and using VCA data to deduce community vulnerability and capacity. I begin by outlining and critiquing the purpose of the VCA and process by which the VCA is produced as per Red Cross protocol. I describe the methods I chose for my study and critique how they were structured. Were the methods chosen and designed using the iterative process described by Dilling and Lemos (2011)? I then determine whether or not the VCA is able to adequately analyze vulnerability as per the components of vulnerability described by Turner et al (2003a) – exposure, sensitivity, resilience/adaptive capacity, and external political, institutional, historical, and economic influences. Furthermore, I determine whether or not the

VCA is able to adequately analyze capacity as per the components of vulnerability described by Jones and Boyd (2011) – social barriers, human/information barriers, and natural/physical barriers/limits. Finally I critique how the information from the VCA is used. How useful is the VCA for stakeholders, including community members and decision makers (primarily from the Red Cross)?



## CHAPTER III

### **The Vulnerability of Communities to Floods**

#### **3.1. The human-environment system**

My research was conducted in the districts of Kazungula and Sesheke, located in the Southern and Western provinces, respectively. In Kazungula, I worked with the communities of Sikaunzwe and Kasaya and in Sesheke, I worked with the communities of Situlu and Sikuzu. All of these communities are located in the Zambezi River Basin, either along the Zambezi River or its tributaries and are flood-prone (Figure 2 and 3). These communities were selected by the ZRC as pilot sites for the ZRBI. The four communities are made up of the Lozi tribe. All four communities are located in Zambezian Baikiaea woodland savannah. Sikaunzwe and Kasaya border Zambezian and Mopane woodland savannah and Situlu and Sikuzu border Central Zambezian Miombo woodland savannah. The soils in these areas are sandy. The floodplains adjacent to the communities are primarily Zambezian flooded grasslands. Zambian climate is characterized as humid subtropical. There are two seasons – the rainy season which occurs from November through April and the dry season which occurs from May through October.



Figure 1. Map of Zambia (extracted from [www.maps.com](http://www.maps.com)), study area indicated with black circle. The Southern border of Zambia with Namibia, Botswana, and Zimbabwe is largely delineated by the Zambezi River. The Zambezi River flows from its source in Northwest Zambia, into eastern Angola, into Eastern Zambia, along the Namibia-Zambia, Botswana-Zambia, and Zimbabwe-Zambia borders, through Mozambique and finally, into the Indian Ocean.



**Figure 2. Map of the study area. The communities studied are indicated with place-marks. Each of the communities are located either along the Zambezi River or its tributaries.**

Sikaunzwe and Kasaya are vast in size. Sikaunzwe is divided into three zones – Nakatindi, Nakalonzwa, and Situwa. Nakalonzwa is located on the lower lands of Sikaunzwe, south of the Ngwezi River and North of the Sesheke-Sikaunzwe tarmac road. It contains the Nakalonzwa dam. Situwa is located on the upper lands and on the east-side of Sikaunzwe. Nakatindi is located to the west of Situwa and in the midst of a confluence of the Ngwezi River and two of its tributaries in the lower lands. Kasaya is also divided into three zones – Mapani East, Simalaha South and Kasaya Central. Mapani East is located near the confluence of the Machile River and Kasaya River, around which there are small swamps. Simalaha South is located south of the Sesheke-Livingstone road and north of the Zambezi River. The majority of the villages are locked between the Zambezi, Kasaya and Simalaha

Rivers. The area is swampy. Kasaya Central spans either side of the Sesheke-Livingstone road and is near the Kasaya River and is the location of one the community's main dams.

Situlu and Sikuzu are located closer to the Mwandi Fishing Camp than they are to Sesheke town. Sikuzu is located in between the Zambezi and Luanga Rivers. Situlu is a vast community, not in terms of population, but in terms of area. It contains several rivers and streams, including the Luanga River and the Mutima, Litopu and Tukutu Streams. The villages on the west end of Situlu are generally on higher lands and the villages on the north side are in much closer proximity to the streams.

I focus on impacts of floods in this study because floods are significant risk in these communities. Over 90% of baseline survey respondents exhibited great concern with regards to natural disasters in all 4 communities. The majority of respondents indicated that both their households and communities were most threatened by floods and/or droughts (Table 4). In addition, one of the goals of the ZRBI is to implement early warning systems in disaster-prone communities. At this stage, shorter-term flood forecasts based on observed or expected rains in the upper Zambezi are more reliable than the seasonal forecasts based on ENSO that are used to predict droughts. A major factor in the success of community-based early warning is the reliability of the forecasts generated and disseminated, and therefore, the ZRC felt that it would be better to focus on floods (Patt and Gwata, 2002).

Response	Kasaya	Sikaunzwe	Sikuzu	Situlu
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<b>Don't know</b>	0%	3.57%	0%	0%
<b>Droughts</b>	89.66%	85.71%	100%	100%
<b>Diseases (Animal and Human)</b>	0%	3.57%	0%	8.70%
<b>Floods</b>	100%	64.29%	100%	91.30%
<b>Fires</b>	0%	8.93%	0%	8.70%
<b>Rains</b>	10.34%	26.79%	0%	21.74%
<b>Extreme Temperature</b>	3.45%	0%	0%	13.04%
<b>Tropical cyclone/hurricane</b>	0%	0%	0%	4.35%
<b>Severe storms</b>	0%	0%	30%	8.70%
<b>High waves/swells</b>	0%	1.79%	0%	0%
<b>Locusts</b>	0%	5.36%	0%	0%

**Table 4. Percent of respondents concerned with different types of natural hazards threatening their communities.**

In the focus-group discussions, participants made a number of allusions to their desired futures. One participant stated the floods make them unstable, causing them to move from the lower lands to the upper lands, search for food and water, and as a result live almost nomadic lifestyles. This participant stated that his community needed help to instill some sort of stability where they could be secure and not have to move because of the floods. Another participant stated that her hope was for a future free from worries about droughts and floods. A third participant stated that she wanted a future where a person could “eat breakfast, lunch, dinner, and supper”, indicating a future with food security (Sikuzu Focus Group Discussion, 2013).

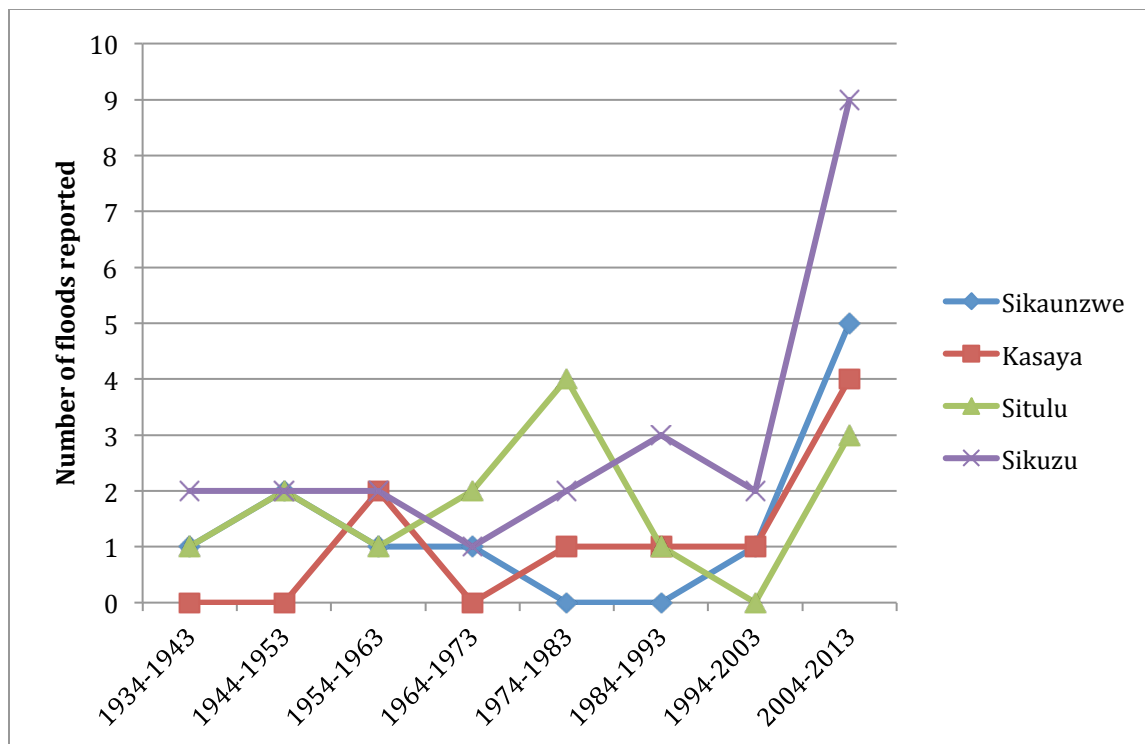
The future valued by the ZRC for these communities is also important given that the ZRC is using these communities as pilot sites for the ZRBI. The future valued by the ZRC is evident in the ZRBI goal of increasing disaster preparedness and risk reduction in communities as a means to increase individual and community resilience and reduce vulnerabilities to recurrent disasters. In essence,

the ZRC wants these communities to be more resilient and less vulnerable to change and variability.

## **3.2. Exposure**

### **3.2.1. Frequency**

As mentioned earlier, the rainy season is from November through April. The heaviest rains occur in January, February and March and are the most likely to cause floods. Respondents in the historical data collection and participants in the focus group discussions reported at least eighteen floods since 1942. Since 2003 alone, eight flood have occurred. The historical data indicates that flood frequency has increased in Sikuzu, Kasaya, and Situlu with flood frequencies hitting their highest mark in 2004-2013 (Figure 3, the historical flood profiles of each community can be viewed in Appendix 6). However, it is hard to say if this is really the case. It is possible that these communities have experienced more floods than what has been recorded given that individual memory deteriorates over time (Cutter et al, 2008). Despite, this the majority of respondents (100% in Kasaya, Sikuzu and Situlu, and 89.47% in Sikaunzwe) stated that their communities had been affected by natural disasters in the last 5 years and 93.1%, 76.9%, 100% and 87.0% of respondents from Kasaya, Sikaunzwe, Sikuzu and Situlu, respectively, stated that floods had occurred in the last 5 years. In all 4 focus group discussions, participants stated that floods occur every year.



**Figure 3. Frequency of floods in all 4 communities**

### 3.2.2. Magnitude

These floods vary in magnitude and severity. In Sikaunzwe, a focus group participant stated that floods had become more severe (Sikaunzwe Focus Group Discussion, 2013). In Kasaya, a focus group participant stated that there are two types of floods. The first type is caused by heavy rains and cause muddy areas (primarily the floodplain) to get filled with water. The second type consists of the floods that occur on the eastern side due to heavy rains upstream. These floods are the most serious (Kasaya Focus Group Discussion, 2013). Using the historical data, it is difficult to gauge whether or not flood severity (as measured by water levels) has in fact increased. Respondents reported different water levels for the same flood. For example, respondents for Sikaunzwe's historical data collection stated that the water levels during the 2006 floods were knee high, 3.5 m high and 1.5 m high. This

is expected given that topography, soil porosity, hydrology, and land use vary such that there will be variation in floodwater levels across space (Garrote and Bras, 1995; Stieglitz et al, 1997; Liu and De Smedt, 2004). In addition, some respondents simply stated that water levels were ‘high’ and did not state a specific measurement (Appendix 6). In order to truly gauge whether or not floods have become more severe, historical flood gauge data would need to be analyzed.

The historical data does show that flood water levels can be anywhere from ankle high to chest high. Ankle high water is enough water to cause damage to fields and cause disease outbreaks (as evident in the floods of 1937, 1959 and 2007 in Sikuzu). What the historical data does show is that more recent floods have the same (or highly similar) impacts as historical floods. These impacts include crop failure (especially maize), destruction of crop fields, soil erosion, destruction of grazing pastures, hunger/starvation/malnutrition, water contamination, human disease outbreaks (especially malaria, diarrhea, and bilharzia), animal disease outbreaks (especially foot-and-mouth disease), and livestock death (Appendix 6). Therefore, it seems that floods of all magnitudes greatly impact households and communities and that something other than flood magnitude is causing the sensitivity of these communities to floods.

### **3.2.3. Duration**

In Situlu a focus group participant stated that floodwaters would remain in a particular area for 2 months (Situlu Focus Group Discussion, 2013). Another participant from Kasaya mentioned that people are disturbed by floods for at least



four to six months, not only because of standing water, but because of the starvation, livelihood loss and infrastructural and property damage caused by floods (Kasaya Focus Group Discussion, 2013). Flood impacts persist beyond the duration of the actual flood.

#### **3.2.4. Areal Extent**

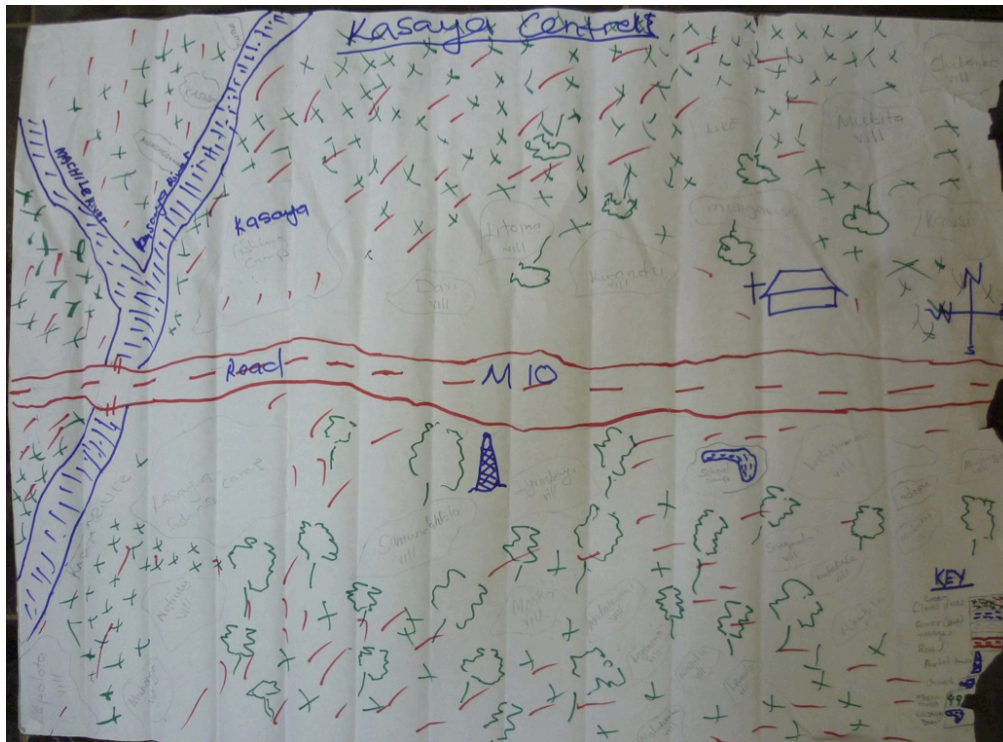
The flood maps for all 4 communities show that the floods tend to submerge the plains around the rivers and streams. In Kasaya, Mapani East is highly vulnerable when the Kasaya River floods. The most flood prone villages and fields are those adjacent to Kasaya and Liapemba Rivers. Floodwaters advance very quickly from the Kasaya River into the Mapani East area (Kasaya Hazard Mapping Session, 2013, Figure 4). In Simalaha South, the villages, fields and pastures are highly flood prone because they are locked between the Kasaya, Zambezi and Simalaha Rivers (Kasaya Hazard Mapping Session, 2013, Figure 5). In Kasaya Central, villages tend to be located in the upper lands and are therefore spared during floods. However, these villages' fields are located in the lower lands, along the floodplains of the Kasaya River and are therefore extremely flood prone (Kasaya Hazard Mapping Session, 2013, Figure 6).



Figure 4. Hazards map for Mapani East, Kasaya.



Figure 5. Hazards map for Simalaha South, Kasaya.



**Figure 6. Hazards map of Kasaya Central, Kasaya.**

In Nakalonzwa, Sikaunzwe, floods seem to occur primarily due to the flooding of the Nakalonzwa dam. The villages on the south-side of Nakalonzwa are especially prone to flooding. Water enters the fields and washes away the crops and the topsoil. It is also common for the Sesheke-Livingstone road in this area to get submerged, making access into and out of the area difficult when there are floods (Sikaunzwe Hazard Mapping Session, 2013, Figure 7). Situwa, located on the upper lands of Sikaunzwe is not very prone to floods. Rather, they face problems with droughts (Sikaunzwe Hazard Mapping Session, 2013, Figure 8). Nakatindi, however is flood prone, especially in the area surrounding the Ngwezee River where the small streams collect a lot of water. The roads in the Nakatindi area can get submerged during the floods, making access to the villages difficult (Sikaunzwe Hazard Mapping Session, 2013, Figure 8 and Figure 9).



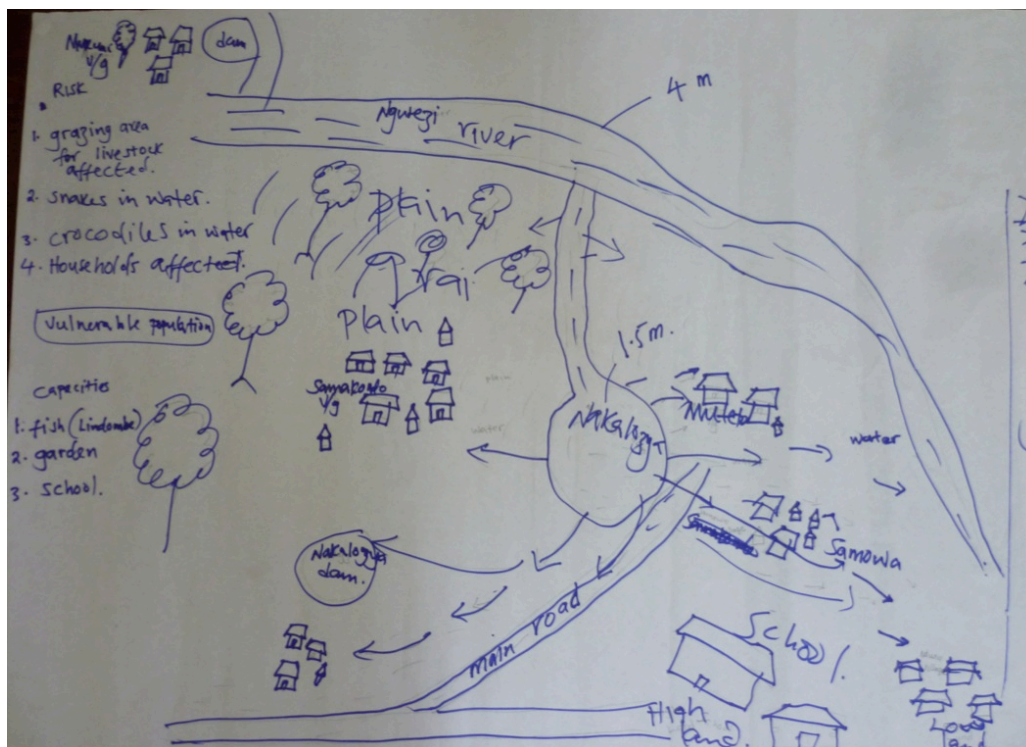
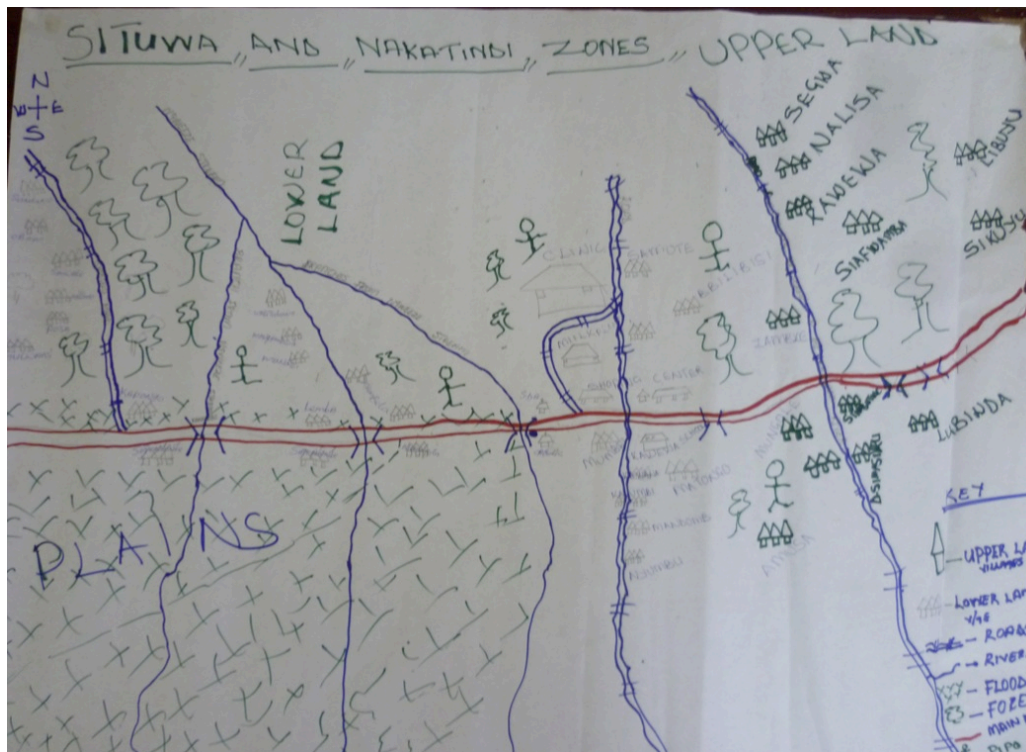
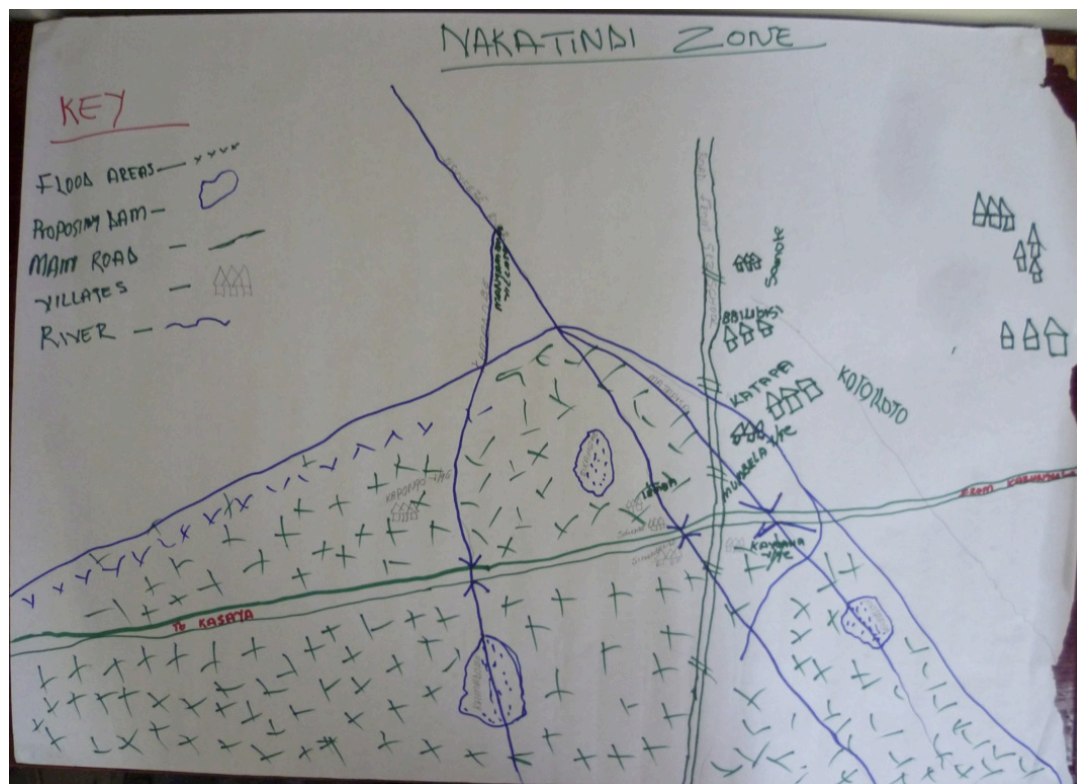


Figure 7. Hazards map for Nakalonzwa, Sikaunzwe. Blue arrows indicate direction of water flow during floods.



**Figure 8. Hazards map for Nakatindi and Situwa, Sikaunzwe. Situwa is located on the upper land to the east and is more affected by droughts and water scarcity. Nakatindi is located on the west of the eastern most road on the map.**



**Figure 9. Hazards map for Nakatindi, Sikaunzwe. Community members have suggested sites for dams on the map.**

The hazards map of Sikuzu shows the direction of floodwater flow. Floodwaters travel from the Luanga River in to the fields and villages adjacent to the Zambezi River. Interestingly, households in villages in the path of the flood, i.e. Aluni, rarely get submerged. The submersion of fields is a much more prevalent issue (Sikuzu Hazard Mapping Session, 2013, Figure 10). In Situlu, the village in the western part are generally on higher lands and are therefore not very flood prone. The villages on the north side, however, are very flood-prone due to their proximity to the streams. The hazards map shows the floods mainly occur around the Luanga River and can reach the tarmac road. Both fields and villages are located in this area. In Situlu, floodwaters are unable to drain back into the Zambezi River and

[illegible]

**Figure 10. Hazards map for Sikuzu. Red arrows indicate direction of water flow during floods.**





Figure 11. Hazards map of Situlu.

### 3.3. Political Context

During colonial times, the 4 communities were located in Barotseland, a region in Western Zambia that cut into Namibia and Angola. Currently Barotseland includes the Western Province of Zambia; Kazungula district is no longer a part of Barotseland, however Sesheke is. Barotseland is the land of the Lozis, an indigenous group that are the majority in the area. It is ruled by the Lozi chief.

Barotseland was and remains a contested territory. Since colonial times, they have been seeking secession. In 1964, Kenneth Kaunda, the Prime Minister of Northern Rhodesia (now Zambia) signed the Barotseland Agreement which incorporated the Northern Rhodesian portion of Barotseland into Zambia and gave the Lozis limited autonomy in matters of government, land and resources. During this time, Barotseland was governed according to Lozi customary laws (Caplan, 1970). However, tensions mounted when all of Barotseland was incorporated into Zambia's Reserves and Trust land laws in 1970, stripping Barotseland of its autonomy. By 1972, all of the land in Zambia was vested under the President (van Loenen, 1999). Barotseland continued to lobby to remain a separate state and at times wanted to completely secede from Zambia. In retaliation, the Zambian government starved the Barotseland area of resources and left it underdeveloped. Infrastructure remains very poor without proper roads, electricity, water, and communications systems (Noyoo, 2012).

### **3.4. Sensitivity**

#### **3.4.1. Socioeconomic endowments**

Sensitivity to floods is associated with agricultural dependency (Wilcoxon Mann-Whitney,  $z=1.678$ ,  $p < 0.05$ , Table 5) . The majority of respondents practice subsistence agriculture, making agriculture the most important income source in all 4 communities (**Figure 12**). Almost 96% of households cultivate. Farmers largely practice smallholder agriculture, planting 0-5 acres during a given agricultural season. The most dominant crop planted in all 4 communities is maize even though



the returns are marginal (Holmes and Slater, 2007). Many farmers do not produce enough harvest to be able to sell the surplus; fifty percent of survey households from Kasaya, 35.71% from Sikaunzwe, 66.67% from Sikuzu, and 82.61% from Situlu stated that they do not sell their agricultural products. The susceptibility of agriculture to floods was demonstrated throughout the focus group discussions and historical data collection where participants and respondents stated that floods wash away crops, damage fields and cause crop failures. This in turn results in malnutrition/hunger/starvation because people do exist at the subsistence level (Sikaunzwe Focus Group Discussion, 2013; Situlu Focus Group Discussion, 2013; Situlu Focus Group Discussion, 2013; Appendix 6). Starvation and malnutrition can stunt the physical development of children in the community<sup>1</sup>. Food insecurity and the loss of livelihood will slow down recovery from the flood.

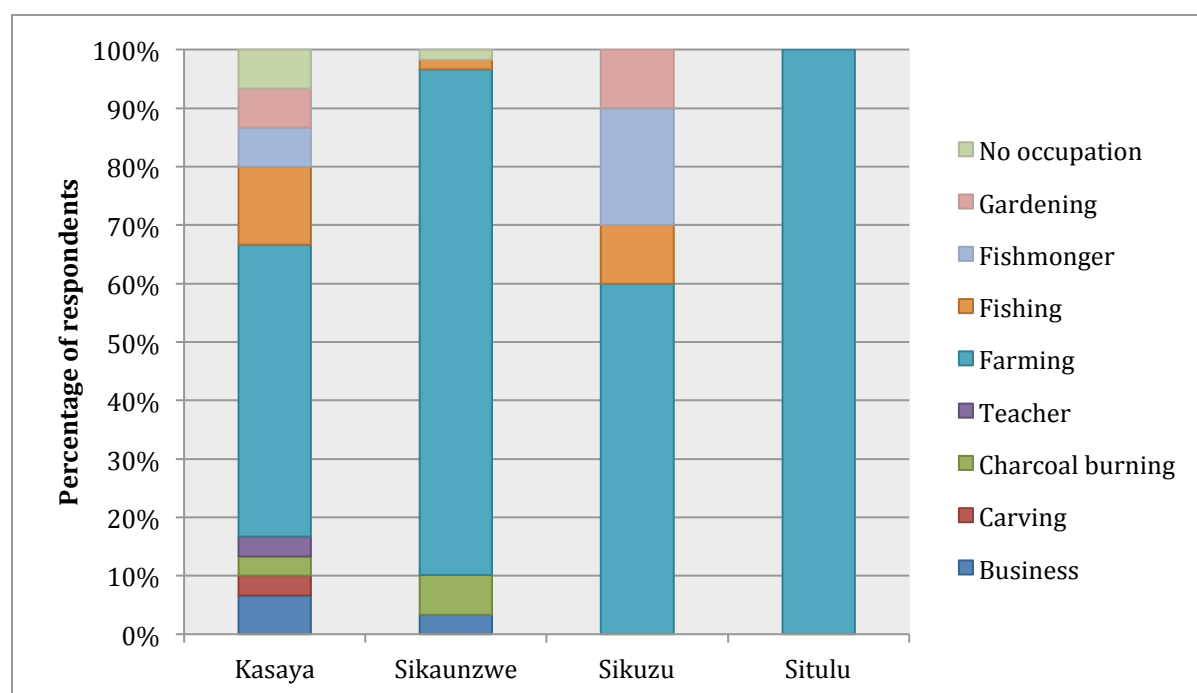
<b>Hypothesis</b>	<b>Statistical test</b>	<b>Test result</b>	<b>Implication</b>
Wealth is associated with sensitivity to floods	Kruskal-Wallis	chi-squared with ties = 18.909 with 15 d.f. probability = 0.2179	The null hypothesis that wealth is not associated with sensitivity to floods cannot be rejected.
Educational attainment is associated with sensitivity to floods	Kruskal-Wallis	chi-squared with ties = 6.892 with 7 d.f. probability = 0.4402	The null hypothesis that educational attainment is not associated with sensitivity to floods cannot be rejected.
Having/not having a secondary livelihood is associated with sensitivity to floods	Wilcoxon-Mann Whitney	z = 1.678 Prob >  z  = 0.0934	The null hypothesis that having a secondary livelihood is not associated with sensitivity to floods cannot be rejected.
Agricultural	Wilcoxon-	z = 2.430	The null hypothesis that

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<sup>1</sup> School-going children get at least one meal a day through the Zambian government's school-feeding programme – this should help curb malnutrition, to some degree, within the youth.

dependency is associated with sensitivity to floods	Mann Whitney	Prob >  z  = <b>0.0151*</b>	agricultural dependency is not associated with sensitivity to floods is rejected.
Household construction quality is associated with sensitivity to floods	Kruskal-Wallis	chi-squared with ties = 0.920 with 3 d.f. probability = 0.8207	The null hypothesis that household construction quality is not associated with sensitivity to floods cannot be rejected.
Distance to primary water source is associated with sensitivity to floods	Simple logit regression	Number of obs = 115 LR chi2(1) = 0.48 Prob > chi2 = 0.4902 Log likelihood = -65.767827 Pseudo R2 = 0.0036	The null hypothesis that distance to primary water source is not associated with sensitivity to floods cannot be rejected.
Gender is associated with sensitivity to floods	Wilcoxon-Mann Whitney	z = -2.508 Prob >  z  = <b>0.0122*</b>	The null hypothesis that gender is not associated with sensitivity to floods is rejected.

**Table 5. Statistical tests conducted to gauge associations between socio-economic endowments and household sensitivity to floods. Test results significant at the p=0.05 alpha level are bolded and starred.**



**Figure 12. Primary occupations of survey respondents**

Food insecurity, however, is not solely caused by climate shocks. Rather, conditions and systems that cause weakened food systems are in place. According to

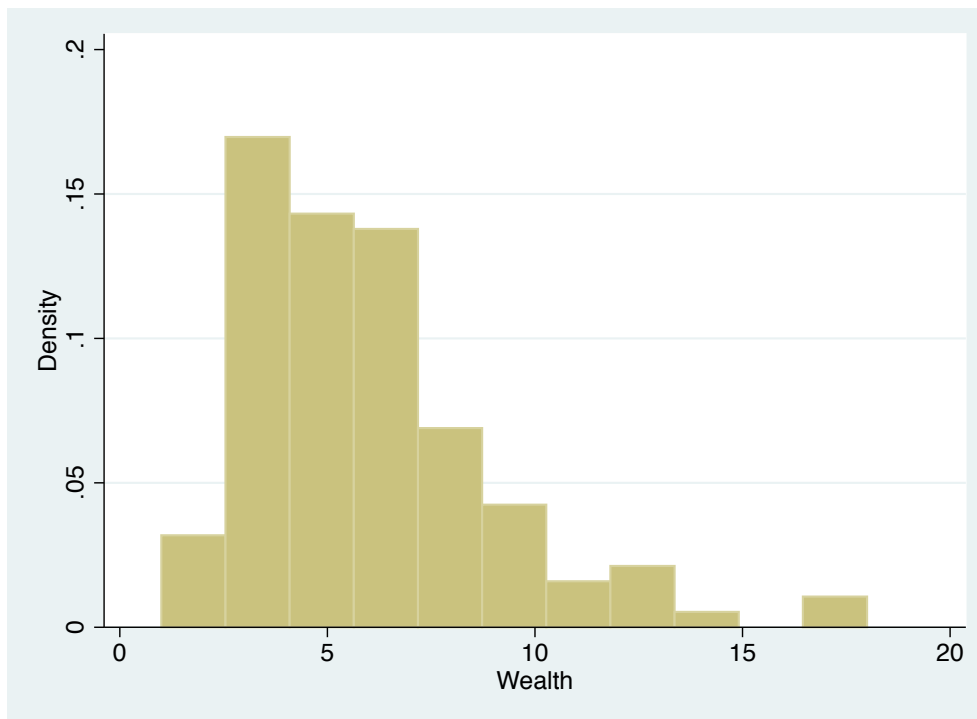
Gregory et al (2005), food insecurity results from a combination of poverty, lack of education, increases in food prize, unavailability of employment, failures in property rights, poor market access and climate/environment. A large proportion of the respondents do not have sources of non-farm income and/or do not have secondary occupations. In short, there is a lack of alternative livelihoods (Table 6). Interestingly, having/not having a secondary livelihood was not associated with household sensitivity to floods (Table 5). This is potentially because turning to a secondary livelihood such as charcoal burning, making mats from reeds, selling cut reeds, etc, does not actually reduce household sensitivity to floods due to the lack of market/demand for the goods produced (Sikuzu Focus Group Discussion, 2013). Situlu and Sikaunzwe seem to have particularly poor market access.

	Kasaya	Sikaunzwe	Sikuzu	Situlu
% Respondents without non-farm income	44.83%	35.09%	40%	69.57%
% Respondents without secondary occupation	43.33%	28.81%	20%	60.87%
% Respondents without secondary occupation and non-farm income	30%	22.03%	10%	47.83%

**Table 6. A lack of alternative livelihoods.**

As mentioned above, poverty can cause food insecurity (Gregory et al, 2005). Poverty is also an indicator of marginalization because it is directly related to resource access which is important in the face of hazards and risks (Adger and Kelly, 1999). All four communities are poor. The majority of respondents – 59.26% in Kasaya, 70.18% in Sikaunzwe, 70% in Sikuzu and 66.67% in Situlu – live in thatched mud huts (thatched roofs, mud walls, and mud floors) with 1-2 rooms. In Kasaya and to a lesser extent in Sikaunzwe and Situlu, there has been a shift from

thatched roofs to iron sheet roofs. Over 95% of the households surveyed do not have electricity and over 97% of households surveyed do not have piped water in their homes. Figure 13 shows that household-level wealth is positively skewed and that most households have lower wealth index scores.



**Figure 13. Histogram of household-level wealth.**

However, wealth was not associated with household sensitivity to floods (Table 5). A possibility is that my wealth index is not an accurate representation of household wealth. In addition, it may be because I did not take into account other indicators of wealth such as income, acres of land owned/farmed, and so on, or weight the chosen wealth indicators appropriately when calculating my index. Nevertheless, participants in the focus group discussions indicated that their poverty made it difficult for them to respond to floods and the aftermath of floods.

They claimed they had no resources, that they were unable to afford food in the market, and that they needed food relief from the government, ZRC, or other NGOs. Furthermore, while poverty exacerbates the effects of floods, floods also exacerbate poverty through the loss of livelihood and resource expenditure to fix/rebuild houses and buy food and supplies to survive in the short-term. Focus group participants stated that they had to rebuild their houses every year (Kasaya Focus Group Discussion, 2013; Sikaunzwe Focus Group Discussion, 2013; Sikuzu Focus Group Discussion, 2013; Situlu Focus Group Discussion, 2013). Communities are therefore forced to sell productive capital such as property and livestock and spend the limited resources they have when hazards occur so they can bear the cost of their immediate needs.

Disaster vulnerability has been linked to educational attainment. A lack of education can restrict lifetime earnings and also make it harder for individuals to access and understand warning and recovery information (Cutter et al, 2003). There seems to be a serious effort by households to educate their children (Table 7). These children, in their primary and secondary years, are educated in community-run or government schools located in their areas. Most of the government schools and community-run schools in these areas, however, do not have an upper secondary school (Kasaya Focus Group Discussion, 2013). Families send their children to boarding schools in nearby towns if they can afford to. The inability of households to afford boarding school is suggested by the significant drops between the percentage

of households with members educated to at least Grade 9 and those with members educated to at least Grade 10 in all 4 communities (Table 7).

% HH surveyed with member having completed...	Kasaya	Sikaunzwe	Sikuzu	Situlu
Grade 4	100%	100%	100%	100%
Grade 5	100%	91.23%	100%	100%
Grade 6	100%	91.23%	90%	100%
Grade 7	93.33%	91.23%	80%	100%
Grade 8	70%	70.18%	60%	86.96%
Grade 9	66.67%	56.14%	40%	82.61%
Grade 10	40%	28.07%	0%	47.83%
Grade 11	30%	22.81%	0%	34.78%
Grade 12	30%	15.79%	0%	26.09%
College	3.33%	0%	0%	0%

**Table 7. Levels of education in all 4 communities.**

While my statistical analyses suggest that educational attainment is not associated with household-level flood sensitivity, the focus group discussions attested to the important of education for coping with disasters (Table 5). In Sikaunzwe, female focus group participants stated that they needed to be educated in skills that could be used to generate income. They also stated that they needed to be educated on how to maintain their rangelands (Sikaunzwe Focus Group Discussion, 2013). Furthermore, in the baseline survey, some community members from Kasaya, Sikaunzwe and Situlu reported having received rainfall forecasts from the Met in the past. These mainly seem to have been seasonal forecasts which were then used by community members to prepare their fields. However, some did not use the forecasts that they received (Table 8). When asked why, they gave the following reasons: (1) lack of knowledge about the forecast, (2) prefer to wait for a situation and act accordingly, and (3) unsure about forecast reliability. This

indicates that knowledge/education is needed to decrease community and household sensitivity to disasters.

	Kasaya	Sikaunzwe	Sikuzu	Situlu
Total households	29	56	10	23
Number of households that have received a forecast in the past	3	14	0	10
Number of households that did not use the forecast	2	5	0	0
Number of household that used the forecast	1	9	0	10

**Table 8. Rainfall forecast access and use.**

Floods also negatively affect education. Focus group participants from Situlu and Sikuzu stated that children cannot attend school during the floods because the roads from their villages to the schools get submerged (Sikuzu Focus Group Discussion, 2013; Situlu Focus Group Discussion, 2013). In Sikaunzwe, focus group participants stated that the floods have the tendency to contaminate water sources in the community. Therefore, community members need to go further away to collect water for the household. Children do not go to school for 2-3 weeks during these times because the adults need their help for carrying water from the water source back to the house (Sikaunzwe Focus Group Discussion, 2013).

Water accessibility, as suggested above is a major problem for households. Although water accessibility was not statistically associated with community sensitivity to floods, it was indicated in all four focus groups that water accessibility is a problem. In Sikaunzwe, a female focus group participant stated, “The only help we need is water”. During the floods, the wells and dams that people depend on can

become contaminated<sup>2</sup>. This is partly because waterborne and parasitic diseases like cholera and malaria, respectively, thrive during floods and because people are forced to share their drinking water sources with livestock – it is difficult to take livestock to alternative, farther away water sources when the lands are submerged. In addition, water is scarce in the upper lands. In all communities, focus group participants stated that they needed dams (Kasaya Focus Group Discussion, 2013; Sikaunzwe Focus Group Discussion, 2013; Sikuzu Focus Group Discussion, 2013; Situlu Focus Group Discussion, 2013).

While there are disease outbreaks, communities do not have adequate access to health services or clinics. Only Sikaunzwe and Situlu have clinics that can be used to treat injuries and diseases resulting from floods. During the historical data collection, several community leaders and elderly complained that access to medicines and making it to follow-up check-ups were difficult (Appendix 6). The lack of substantial medical services can lengthen immediate and long-term recovery from particularly severe flooding events.

Household construction quality was not associated with flood sensitivity, however focus group participants in all communities stated that their houses were prone to floods (Table 5). In general, focus group participants exhibit more concern towards their fields than their homes. This could be (1) because fields are located in the flood plain, whereas houses tend to be located further away and are therefore

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<sup>2</sup> In Kasaya, 40% of the households surveyed depend on shallow wells, 33.33% depend on river water, and 30% depend on dams as their main sources of drinking water. In Sikaunzwe, 66.10% of households surveyed depend on shallow wells and 35.59% depend on borewells. In Sikuzu, all households surveyed depend on river water. Finally, in Situlu, 78.26% depend on shallow wells and 21.74% utilize borewells.



less likely to flood and/or (2) because the overall cost of losing a field is greater than the cost of losing a home constructed by locally, freely available materials. However, the reality is that floods will damage homes if the floodwaters reach the villages given that thatched mud hut houses are not permanent structures (Kasaya Focus Group Discussion, 2013; Sikaunzwe Focus Group Discussion, 2013; Sikuzu Focus Group Discussion, 2013; Situlu Focus Group Discussion, 2013).

In addition, infrastructure is poor in all 4 communities, thereby enhancing community vulnerability. The bridges have been damaged/destroyed by floods in the past (Appendix 6). The roads are also prone to becoming submerged. The majority of these roads are not tarmac. Rather, they are graded using sand and floods become rivers of mud that are largely impassable. This is problematic partly because the communities do not have the resources to repair the roads and more so because the communities (especially Situlu, Sikuzu and interior parts of Kasaya and Sikaunzwe) can be entirely inaccessible by road until the floodwaters recede. Cell phone infrastructure is also poor as signal range is limited and intermittent (Kasaya Focus Group Discussion, 2013; Sikaunzwe Focus Group Discussion, 2013; Sikuzu Focus Group Discussion, 2013; Situlu Focus Group Discussion, 2013).

Sensitivity to floods is associated with gender (Wilcoxon-Mann Whitney,  $z = -2.508$ ,  $p < 0.05$ , Table 5). Women are particularly vulnerable to floods. A female focus group participant from Sikaunzwe stated,

In fact, as women we are the most vulnerable people because we are the ones taking care of the children at home. The man, they can just go to the fields. We are taking care of those children. So what we do, we suffer a lot because our job is to look for food for those children.”

Family structure may also contribute to this vulnerability given that many of the men practice polygamy and move between their different households. As a result, the women are largely responsible for the household and care-giving.<sup>3</sup> They also have relatively little access to income – the ‘jobs’ that they perform tend to be at the household level (i.e. gardening). Recently, however, women have gained some support from newly established loans associations which provide women with loans to start small businesses with the aim of empowering them (Sikaunzwe Focus Group Discussion, 2013). It is unclear if women from Kasaya, Sikuzu and Situlu have access to these associations.

Several women in these communities not only care for their children, but often also care for orphan children, the elderly, and the disabled (Table 9). 14.1% of the households interviewed from Kasaya and Sikaunzwe and 12.1% of the households interviews from Sikuzu and Situlu have disabled members. Focus group participants stated that children and the elderly were among the most vulnerable groups (Kasaya Focus Group Discussion, 2013; Sikaunzwe Focus Group Discussion, 2013). A focus groups participant from Kasaya stated that “there are some aged people who cannot do anything now”, making them particularly prone to floods (Kasaya Focus Group Discussion, 2013).

	Kasaya	Sikaunzwe	Sikuzu	Situlu
Avg. number of individuals/HH	4.90±2.37	5.07±2.16	5.1±1.37	5.48±2.27
Avg. number of males/HH	2.93±1.64	2.54±1.41	2.6±1.51	2.83±1.72

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<sup>3</sup> Personal observation

Avg. number of females/HH	1.93±1.36	2.54±1.62	2.50±1.43	2.70±1.43
Avg. number of infants (0-5 yrs)/HH	0.77±0.77	0.54±0.68	0.90±0.57	0.74±0.86
Avg. number of children (6-17 yrs)/HH	1.97±1.88	2.36±1.72	2.30±0.95	2.30±1.64
Avg. number of elderly (65+ yrs)/HH	0.23±0.43	0.25±0.48	0.10±0.32	0.48±0.59
Avg. number of HH members enrolled in school	1.83±1.64	2.34±1.68	2.60±1.07	2.48±1.68

**Table 9. Summary of HH constituents. Errors reported are standard deviations.**

### 3.4.2. Social Capital

Social capital is required as a means of obtaining informal resources during times of crisis. Social networks that people rely on during times of crisis are made up of several social actors. In the context of the 4 communities, these can include community members, village headmen and community leaders.

Each of the communities contain villages. Each village has a headman or headwoman who serves as the decision-making authority for the village and generally ensures that village life runs smoothly. The village headmen, in turn, report to community leaders. The villages all vary in size – some villages have just one household, whereas others can have over 50 households. It is common to see clusters of households surrounded by grass fences within the villages. These clusters are family compounds in which the household head lives in the main house and the surrounding houses are for his/her spouse(s), children, and/or relatives.

As mentioned earlier, the males are polygamous and the wives can be scattered throughout different villages. A possible advantage of such a family system is that it expands the social networks (and therefore the financial and psychological resources) available to individuals. However, studies have found that

polygamous family structures in poor communities do not necessarily expand social networks or build social capital because family relationships in such situations can be “fragile, contested, and constraining” due to inter-family politics and the inability of relatives to monetarily afford keeping in contact (Cleaver, 2005).

In the Sikaunzwe and Kasaya focus group discussions, participants stated that they had ‘manpower’ in terms of flooding. In addition, community members in Sikaunzwe come together, under the Community Agricultural Committee to write reports to the government, requesting flood relief (Sikaunzwe Focus Group Discussion, 2013). This suggests that community members can be brought together to work on a collective issue. Furthermore, village headmen and community leaders are deeply respected and have greater authority than the other community members to mobilize people and resources. In effect, the leaders have great social capital and can tap more easily into existing networks for the collective good (Sikaunzwe Focus Group Discussion, 2013).

A further concern is that floods can actually harm social networks and capital. A focus group respondent described some contention between the elders and the younger community (Sikaunzwe Focus Group Discussion, 2013):

“The elders try and tell the community and some will move to the upper land, but you find that those that are younger still plant in the lower lands and if the floods come, they will wipe away all their crops.”

In addition, respondents in the historical data collection reported a number of cases where the stress and shock from floods had caused domestic disputes (Appendix 6).

Such contentions can harm relationships and therefore social networks and social capital.

### **3.4.3. Physical/Natural Endowments**

All 4 communities practice livelihoods (agriculture, fishing, charcoal burning, selling grasses/reeds) which are tied to the land and available natural resources. Fields tend to be located in the lower lands, in the floodplains, due to the water availability and soil fertility. The upper lands are too dry and the soils are too sandy. However, the clearing of trees to make way for fields has resulted in soil degradation. As a result, fields are moved closer and closer to the river. According to a focus group participant in Sikaunzwe, the soil degradation has caused the river to become shallower and flood more easily (Sikaunzwe Focus Group Discussion, 2013).

Water is a major problem for the communities of Kasaya, Sikaunzwe (primarily Situwa) and Sikuzu because they are above a salt water aquifer. These communities, therefore, cannot use boreholes and wells. Rather, they are reliant on dams and nearby rivers for water (Kasaya Focus Group Discussion, 2013; Sikaunzwe Focus Group Discussion, 2013; Sikuzu Focus Group Discussion, 2013).

## **3.5. Resilience**

The resilience of these communities is not mutually exclusive from their sensitivity. Resilience and sensitivity interact and feedback into each other, as indicated by Turner et al's (2003) framework. In this section, I describe the resilience of communities in terms of how communities have responded to floods in

the past, how they currently respond, their perceptions of preparedness and capacity, and their actual preparedness and capacity.

Looking at the data, all four communities seem to have low coping and adaptive capacities. While respondents in the historical data collection indicated a range of flood responses – no response, shift from lower lands to upper lands for shelter, shift livestock from lower lands to upper lands for pastures, construct ridges to obstruct floodwaters, dig furrows to drain floodwaters, farm on anthills, eat wild fruit (before 1980), request government assistance, and switch to alternative livelihoods (mainly fishing, cutting and selling reeds, charcoal burning, making mats, and gardening) – it is evident that, more often than not, community members do not respond (Appendix 6). Historically, community members were more inclined to shift to the upper lands during floods, forage for wild fruit, and eat a type of local grass (Sikaunzwe Focus Group Discussion, 2013; Situlu Focus Group Discussion, 2013; Situlu Focus Group Discussion, 2013). However, it seems that communities have become more hesitant to respond or adapt to floods in recent times. Temporary dislocation for cultivation, grazing and/or shelter purposes can negatively impact household members mentally (e.g. stress/shock due to hazard and its impacts), socially (e.g. domestic and social disputes due to stress/shock) and economically (e.g. cultivating on unfamiliar lands) (Appendix 6).

In Kasaya, focus group participants stated that, in the past, they would evacuate and go to the higher lands with their livestock. Other participants stated that they would go to Kazungula town and try to generate some income by doing

small jobs (mostly domestic help). Now, they normally do not take any actions to minimize their risk against floods and do not take actions when traditional forecasting methods indicate a flood is arriving. They also stated that they did not take any measures after a flood, i.e. contacting the government for help and relief. The bulk of their actions consist of rebuilding their houses if they get damaged and waiting until the next opportunity to plant crops. In addition, some individuals catch fish during the floods to feed their families and sell in the market (Kasaya Focus Group Discussion, 2013).

The Sikaunzwe community, on the other hand, seems to be more proactive in flood response. They have a Community Agricultural Community that congregates after floods to write reports to the government requesting help. Focus group participants stated that, in the past, they would write reports immediately after the flood and by May or June, the government officials would come to the community to determine how many people were affected by the floods and accordingly distribute food relief (primarily maize meal). However, in recent times, these reports have largely been unanswered and unacknowledged by the government. One participant stated, “We have tried by all means to take reports to the government saying please the water will kill us. Nothing has been done”. Focus group participants also mentioned that, in the past, they had tried to “mend the cracks” in the ground near the river through which floodwaters come using Mopani poles and sand, but that these efforts were unsuccessful. When asked what they do when floods wash their crops away, participants stated that many do not attempt to cultivate until the next

season unless external organizations (primarily NGOs) distribute seeds. For the most part, community members turn to alternative livelihoods, i.e. small businesses (selling fish, charcoal, and reeds). Women have found some support through recently established loan associations which provide women with loans to start small businesses (Sikaunzwe Focus Group Discussion, 2013).

In Sikuzu, focus group participants also stated that they moved to the upper lands during floods in the past. In the upper lands, they would cultivate on anthills and termite mounds until the floodwaters receded and they could return to the lower lands. Now, they are more likely to stay in the lower lands unless the government evacuates them. A female focus group participant stated that when crops fail, she and other women go into the bush and collect grass and reeds that they sell to generate some income. Some women also garden, however, these gardens can only be kept for a short period of time due to water availability issues. A male focus group participant stated that the men go to the floodplains when there is crop failure. Historically community members would go to Namibia to sell produce and other items and look for jobs; however, this has become difficult due to stricter border control (Sikuzu Focus Group Discussion, 2013).

In Situlu, several focus group participants stated that they did nothing when their crops failed. A focus group participant stated, “We do nothing, we just stay like that”. When pushed further, they stated that the only alternative to farming was to go to the riverside and catch fish. However, community members are afraid of going to the riverside due to the presence of crocodiles that have killed



community members in the past. Furthermore, focus group participants stated that they only go to the upper lands to find grazing pastures for their livestock. Otherwise, they remain in their homes in the lower lands. A male focus group participant stated that community members had unsuccessfully attempted to block floodwaters from entering their fields in the past by digging furrows and drainages (Situlu Focus Group Discussion, 2013).

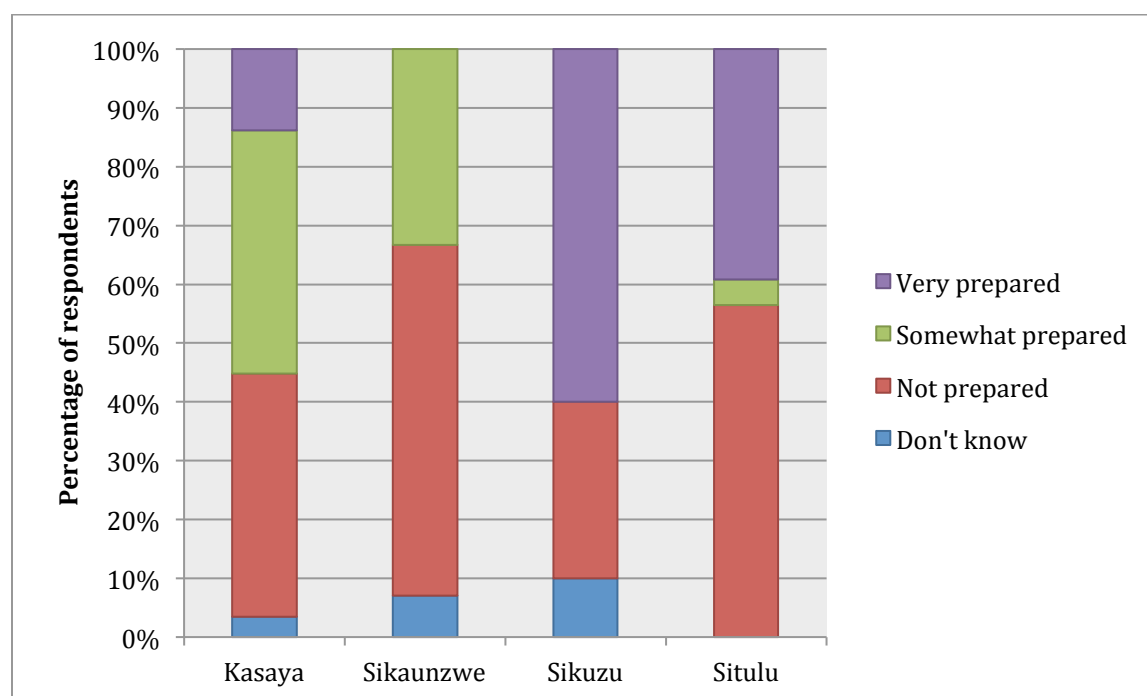
Although community members do turn to alternative livelihoods when floodwaters wash their crops away and damage their fields, they are generally unable to generate enough income to afford food due to the lack of markets in which to sell their products. This is evident in the historical data collection where starvation, hunger and malnutrition are commonly listed consequences of floods (Appendix 6). A male focus group participant from Sikaunzwe stated, “the NGOs try to help” with relief food, “but we are many. Those that can afford [food], they can buy”, but the majority cannot. A female focus group participant from Sikuzu stated that most households were restricted to only eating once a day in the face of food insecurity caused by the floods (Sikuzu Focus Group Discussion, 2013).

A major part of the problem is that community members and communities, overall, are not prepared to deal with floods. Household sensitivity to floods is associated with household preparedness (Kruskal Wallis,  $\chi^2 = 11.812$ , 2 df,  $p < 0.05$ ).<sup>4</sup> Household members themselves do not feel that their households are

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<sup>4</sup> Whether or not households have spoken about disasters or not in their homes is only one element and not a holistic indicator of preparedness. However, it is widely accepted that preparedness reduces susceptibility to disasters.

prepared to deal with floods (Figure 14). Of those respondents who claim that their households are very or somewhat prepared to handle disasters, many do not have supplies they perceive can be used in emergency situations and/or have not spoken about or planned for what to do if a disaster occurs (Table 10).<sup>5</sup> Contrary to what is indicated in Figure 14, focus group participants from Sikuzu stated that they were not prepared to deal with floods (Sikuzu Focus Group Discussion, 2013). This can be partly attributed to the lack of access to forecasts. Without forecasts, communities and households cannot take anticipatory action (Table 8).



**Figure 14. Perceptions of household-level preparedness to deal with disasters.**

	Kasaya	Sikaunzwe	Sikuzu	Situlu
Total respondents	29	57	10	23
No. respondents who claim to be	16	19	6	10

<sup>5</sup> It is possible that the baseline survey's definition or representation of preparedness was limited. It may be that respondents need to be asked in what ways they are prepared to handle a disaster in a more open, semi-structured survey format.

somewhat or very prepared for a disaster				
No. respondents who stated they have supplies in their homes which can help in emergency situations	9	12	0	2
No. respondents who stated HH members have spoken/planned what to do if a disaster occurs	16	11	2	6

**Table 10. Preparedness of HH who perceive that they are somewhat or very prepared to handle disasters.**

This lack of household preparedness adversely affects overall community preparedness (Moore et al, 2004). Community preparedness is also affected by the lack of community-based disaster preparedness measures. In all four communities, focus group participants answered ‘no’ when asked if their communities have early warning systems, disaster committees, or disaster plans. This is further evidenced in the baseline survey responses outlined in Table 11. In addition, communities do not seem to be utilizing existing traditional forecasting methods. In all four focus group discussions, participants stated that the presence of cobwebs at the start of the rainy season is an early warning for floods. In Kasaya, a focus group participant stated that large frogs will come out of the ground and cry, also indicating coming floods. However, these warnings are rarely taken heed of because they are not reliable – on several occasions, these warnings have not been followed by floods (Kasaya Focus Group Discussion, 2013; Sikaunzwe Focus Group Discussion, 2013; Sikuzu Focus Group Discussion, 2013; Situlu Focus Group Discussion, 2013).

	Kasaya	Sikaunzwe	Sikuzu	Situlu
% HH stating that community has committee/organized group that decides what to do during disasters	0%	7.14%	0%	4.35%
% HH stating that community has a disaster plan	0%	8.93%	10%	0%

% HH stating that community has an early warning system	3.45%	7.02%	10%	4.76%
% HH stating that community has shelter identified where people can go in the event of a disaster	0%	14.29%	10%	4.76%
% HH stating that community has evacuation routes	3.45%	10.53%	50%	4.76%
% HH stating that community members have been trained to assist others in the event of a disaster	0%	21.05%	0%	14.29%

**Table 11. Existing community-level risk reduction and preparedness measures indicated in the baseline survey.**

Another part of the problem is that households and communities perceive that they do not have capacities that can help them cope with or adapt to flood risk. In all four focus group discussions, participants mainly spoke about capacities in terms of ‘resources’ and repeatedly stated that they have no resources with which to respond to or prepare for floods. In Kasaya, a participant stated,

“We are normally disturbed by these floods, but whenever we see these floods... it’s a part of our life. We are just lacking the resources, as the last speaker has already said. Normally, when these floods occur, we have no capacity to harvest or dam this water.”

In Sikaunzwe, a participant stated, “We don’t have resources, but we have manpower”.<sup>6</sup> In addition, as mentioned earlier, the communities do not have adequate health-related capacities such as clinics. The lack of substantial medical services can lengthen immediate and long-term recovery from particularly severe flooding events (Du et al, 2010; Keim, 2008). What community members do not realize is that they do have resources such as Mopani trees, reeds, sand, manpower,

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<sup>6</sup> While this statement can be interpreted to represent heroism that arises in the context of institutional shortcomings, recent literature suggests that the ‘heroic actor’ narrative should be avoided given that non-entrepreneurial actors are also engaged in actions that facilitate institutional change (Suddaby et al, 2010).

shovels, etc, that can be used to protect their fields and homes from floods. This was also evident in the baseline survey where respondents were asked if they had supplies that could be used during an emergency (Table 10). Many of the households have supplies that could be used during emergencies, i.e. radios and cellphones, that they do not know are supplies.<sup>7</sup>

Community members conflate capacities with resources. Capacities, however, can include social capital or networks, which are both “a source of informal resources and coping capacity (Pelling and High, 2005, p. 315). Capacities can also include links to external organizations that can provide assistance, information (i.e. early warnings), and knowledge (Suarez and Tall, 2010; Jayasinghe, 2013; Eriksen and Selboe, 2012). Overall, households and communities need to realize their existing local capacities.

### **3.6. Conclusion**

In this section, we identified the characteristics of households and communities that indicate vulnerability to floods. Communities are exposed to floods due to their location in the Zambezi River Basin. Flood hazards become disasters because communities are sensitive to floods based on their poverty, lack of education, dependence on agriculture, lack of market/demand for goods, and poor household construction. Women, children and the elderly were recognized as the most vulnerable groups in the communities. Communities also have low coping and

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<sup>7</sup> Percentage of respondents with cellphones – 72.4% in Kasaya, 52.5% in Sikaunzwe, 70% in Sikuzu, and 43.5% in Situlu; Percentage of respondents with radios – 72.4% in Kasaya, 43.4% in Sikaunzwe, 50% in Sikuzu, and 52.2% in Situlu

adaptive capacities in terms of floods. Their lack of preparedness and resources, perception of local capacity, the failure of past flood responses, and their hesitation to evacuate their lands temporarily during floods have disincentivized community members from taking action before, during, and after floods. The sensitivity and low adaptive capacity of these communities occurs in the context of the Zambian government's troubled relationship with Barotseland which has left the Western and part of the Southern provinces critically underdeveloped.

## CHAPTER IV

### Barriers to Adaptation

Both the baseline survey and the focus group discussions, so far, have shown that communities do perceive floods as a recurring risk. Their perceptions of risk, however, are not associated with their actual preparedness (Table 12). This indicates that household perceptions of flood risk do not influence household preparedness; those that perceive floods to be a risk will not necessarily take anticipatory or preparatory actions against floods. Rather, there are other factors at play which determine how these communities will cope with or adapt to floods.

Hypothesis	Statistical test	Test result	Implication
Household preparedness is associated with concern for disasters	Chi-squared	Pearson chi-squared = 2.8876 Pr=0.577	The null hypothesis household preparedness is not associated with concern for disasters cannot be rejected.
Household preparedness is associated with perception of change in disaster frequency	Chi-squared	Pearson chi-squared = 3.8162 Pr=0.702	The null hypothesis household preparedness is not associated with perception of change in disaster frequency cannot be rejected.
Household preparedness is associated with belief that a disaster will/will not occur in the next 5 years	Chi-squared	Pearson chi-squared = 1.7624 Pr=0.779	The null hypothesis household preparedness is not associated with belief that a disaster could occur in the next 5 years cannot be rejected.

**Table 12. Statistical tests conducted to gauge associations between perceptions of risk and actual preparedness at the household level.**

It is evident that community members do not often take measures to prepare for or respond to floods even though they are recurring (Section 3.5, Appendix 6). Year after year, community members lose their homes, fields, and livestock to floods and suffer from a variety of flood-triggered diseases and food insecurity, exacerbating their vulnerability to future shocks. This is not to say that all community members do not respond. For example, during floods, some community members will dig drainages or construct ledges around the perimeter of their homes and fields and/or temporarily shift to upper lands. After floods, some community members may shift to alternative livelihoods or cultivate in upper lands until their fields can be used again. While some community members take such actions, many do not, thereby reducing overall community resilience to climate change and variability. Why is it that these communities are unable to improve their vulnerability through adaptation or improving their adaptive capacity to floods? In this section, I look at the nested contributing factors to the social, human/informational, and physical barriers that prevent communities from taking collective action and reducing their vulnerability. It must be noted that these barriers to adaptation are not mutually exclusive; rather, they are dynamically interacting.

#### **4.1. Political Barriers**

As mentioned in Section 3.3, the political problems between Barotseland and the Zambian government have left the Western province very underdeveloped with



poor infrastructure. Roads are poor – there are few paved roads and the ‘roads’ within the communities are unpaved. When floods occur, these roads are impassable, making it difficult for community members to access higher ground and markets in Kazungula and Mwandi to sell market goods (Kasaya Focus Group Discussion, 2013; Sikaunzwe Focus Group Discussion, 2013; Sikuzu Focus Group Discussion, 2013; Situlu Focus Group Discussion, 2013). In addition, public health services are poor, evident by the lack of government clinics and hospitals in the area. Strong public health services help community resilience and preparedness during and after floods (Keim, 2008). Furthermore, without electricity, storing produce, fish, livestock products to sell or consume during the rest of the year becomes difficult. The lack of water has also been problematic. Over 95% of homes surveyed did not have access to piped water. In Sikaunzwe, focus group participants stated that they were forced to drink water out of the wells and dams used by livestock and that this had caused disease outbreaks (Sikaunzwe Focus Group Discussion, 2013). Cell phone and radios services are also critically underdeveloped, making it difficult for people to access information. Communities, especially Situlu and Sikuzu will have a hard time adapting to floods for as long as the Zambian government deprives the Barotseland area of infrastructure, resources and services.

An additional political barrier is the development of the Simalaha Conservancy. Zambia is attempting to expand its wildlife tourism market and received funding from the WWF Germany and the Swedish Postcode Lottery to

create a new wildlife conservancy in Southwestern Zambia.<sup>8</sup> The goal of the conservancy is to increase elephant populations and to create new wildlife corridors. Therefore, a fence is being built along the boundaries of the conservancy (Sparrow, 2011). While the expectation is that communities will be able to profit from the tourism that the conservancy will bring, the current reality is that communities are being denied access to resources that they need for their survival – this includes the reeds and grasses that community members sell to generate income when their crops have failed and use to construct and repair their homes (Sikuzu Focus Group Discussion, 2013).

These political barriers show that Kasaya, Sikaunzwe, Sikuzu and Situlu have been and continue to be marginalized. Their marginalization and consequent exclusion from decision-making has created institutional problems that hinder their efforts to adapt to flood risk.

## **4.2. Institutional Barriers**

The primary actors that influence community response to floods are the communities themselves, the ZRC, IFRC, donors, the Zambian government, and civil society/non-governmental organizations. Patterns of interactions between different actors result in predictable outcomes. The main outcome of patterns of interactions between vulnerable communities and external agencies with regards to floods has been a lack of collective response to floods at the community-level.

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<sup>8</sup> <http://www.peaceparks.org/programme.php?pid=25&mid=1120>

Patterns of interactions are largely influenced by institutional incentives (Andersson, 2005).

Institutional factors and the nature of the ‘good’ can influence the outcomes of interactions between actors (Andersson, 2006). The ‘goods’ in question are disaster risk reduction and preparedness measures. These can include physical objects such as flood barriers and drainages or services such as alternative livelihood training and preparedness planning. These are public goods in the sense that the one individual’s use of the good does not detract from others’ use of the good and the exclusion of others from using the good is not possible or practical (Andersson et al, 2005).

At the collective-choice level, Zambian government, ZRC and community institutions affect community and individual response to floods. The government has a series of disaster management policies and flood contingency plans<sup>9</sup>. The provincial and district offices of the Disaster Management and Mitigation Unit (DMMU) are responsible for implementing disaster policies geared towards community resilience to climate. A significant focus of these policies is sensitizing vulnerable communities on disaster risk reduction, and government recovery programs (DMMU, 2005; DMMU, 2009; DMMU, 2010). The government also seems to be particularly interested in incentivizing disaster risk reduction and preparedness activities through food for work and/or cash transfer programs (DMMU, 2009). The government does not seem interested in setting rules that will

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<sup>9</sup> The most recent national flood contingency plan I could find was for 2009/2010, therefore my information on current disaster policy and planning is not up to date.

coerce individuals to comply. It is unclear, however, what specific programs have been designed and implemented. It is also unclear when the government started to incorporate disaster preparedness, risk reduction, and recovery into its disaster policies.

The problem here, however, is that existing government institutions are weak and/or bad. Woolcock and Narayan (2000, p. 234) state that “the very capacity of social groups to act in their collective interest depends on the quality of the formal institutions under which they reside”. Decision-making in the government has traditionally been top-down, thereby limiting the scope for feedback through civic engagement (Pritchett and Woolcock, 2004). Communities are unable to directly communicate with key decision-makers (i.e. the ZRC’s Secretary General or the Director of the DMMU); rather, information needs to be passed through numerous channels to reach the decision-maker (ZRC Disaster Management Staff Interview, 2013). Information is lost at every stage. In such a system of missing information and informational asymmetries, it is difficult to evaluate and improve existing institutions and consequently change the underlying incentive structures which determine community actions (Andersson et al, 2005). As a result, there are missing, weak and/or bad institutions.

Government disaster policies and contingency plans are vague. All of these plans, for example, highlight the need for community sensitization on disaster risk reduction, preparedness and government recovery programs, but do not specify targets or objectives that enforcing parties should strive for (DMMU, 2005; DMMU,

2009; DMMU, 2010). Furthermore, monitoring protocol for these programs is unclear. For example, do district and provincial officials need to produce progress reports? If yes, how often? Without monitoring systems in place, district and provincial governments cannot be held accountable regardless of whether they have carried out their duties or not.

In addition, existing government initiatives do not seem to be far reaching. While 40.7% of baseline survey respondents stated that the government has been involved in projects/activities related to reducing disaster risk or vulnerability in the past year, only 2.5 only 2.5% of respondents stated that they had attended a meeting conducted by the government on disaster preparedness; the same percentage of respondents stated that they had participated in an evacuation drill conducted by the government. In addition, while the Zambian Government does have a social protection program in place (highlighted in Holmes and Slater, 2007), community members seem to not know about it (Kasaya Focus Group Discussion, 2013; Sikaunzwe Focus Group Discussion, 2013; Sikuzu Focus Group Discussion, 2013; Situlu Focus Group Discussion, 2013).

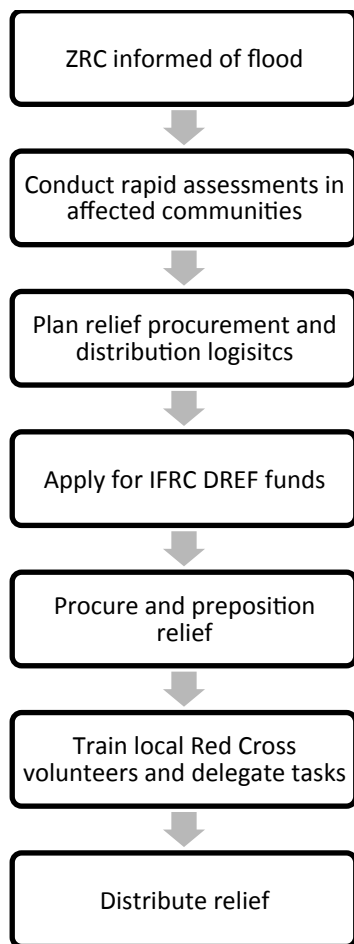
Why are these activities not far-reaching and why do they have such limited community attendance and participation? First, this may be due to the fact that the meetings take place in areas that are difficult to access for community members. Second, this may be because, at the district level, DMMU tasks are delegated to the District Commissioner (DC), who is not a DMMU-specific employee. The DC may not have the motivation to perform DMMU tasks effectively because he/she is (1)

overwhelmed by the responsibilities assigned by other government offices and/or (2) not specialized in or passionate about disaster management. Third, it may be because the government has not adequately incentivized community participation in disaster-related government activities.

Fourth, this may partly be attributed to the ZRC's role in disaster management in Zambia. The ZRC is auxiliary to the Zambian government and is legally mandated to respond to disasters (ZRC Disaster Management Staff Interview, 2013). Therefore, the government may feel less responsible for actively participating in disaster management. In addition, the ZRC has access to funds from international donor communities which can be used fund disaster management activities. In a sense, this is an example of rent-seeking behaviour as government rules regarding the role of the ZRC allow for more international aid to funnel through Zambia. While this does not strictly increase the fortune of the political elite, it allows the Zambian government to spend its limited resources on maintaining the support of groups that are essential for the continued power of the administration as opposed to the welfare of socially excluded and vulnerable groups (Andersson et al, 2005).

In the ZRC, disaster-related decision-making is also traditionally top-down and involves very little community participation or input. Participation is limited to the rapid assessment process where local Red Cross volunteers participate in beneficiary selection; selection, however, is based on criteria outlined by Red Cross protocol. Moreover, decision-making is influenced by the IFRC because they have a

say in how DREF funds (if needed) will be allocated. Decision-making and implementation are top-down (ZRC Disaster Management Staff Interview, 2013). The structure of the ZRC's decision process and the resulting exclusion of community members from humanitarian decision-making does limit social learning, the accumulation of social capital and, consequently, collective action within communities (Adger, 2009)<sup>10</sup>.



**Figure 15. Traditional ZRC response to floods.**

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<sup>10</sup> The implementation of ZRBI goals is expected to eventually allow for greater community engagement in this decision-making process.

The ZRC's top-down relief distribution process has, to some extent, resulted in the Samaritan's Dilemma which is where the "Samaritan prefers that the recipient puts in high effort, but the structure of the interaction guarantees the recipient gives only low effort" (Andersson et al 2005, p. 38). The Red Cross is a humanitarian organization, committed to helping people in need. In the aftermath of floods, this means providing emergency relief. The only community members that are involved in the distribution of relief are local Red Cross volunteers. Otherwise, there is relatively little effort that aid recipients need to put in to receive the aid – the benefit of receiving aid far outweighs the cost of reaching the relief distribution point. The problem with this is that communities have become used to handouts from the ZRC. This was evident while baseline surveys were being conducted and focus group discussions where community members would frequently ask for handouts (Kasaya Focus Group Discussion, 2013; Sikaunzwe Focus Group Discussion, 2013; Sikuzu Focus Group Discussion, 2013; Situlu Focus Group Discussion, 2013). To some degree, ZRC flood response has become a moral hazard given that those who do not take disaster risk reduction and flood response measures are those who most need and are likely to receive humanitarian relief. Individuals are disincentivized from dealing with community vulnerabilities and increasing their resilience to climate due to their reliance on frequent handouts.<sup>11</sup>

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<sup>11</sup> Harvey and Lind (2009) argue that humanitarian assistance does not necessarily create dependency at the community-level. This, however, was not my experience in the field. It could be that this culture of dependency is not fully caused by humanitarian activities, but also by missionary activities in the communities since the early 1900s.



At the operational level, community members' actions are governed by informal and formal institutions. Communities contain several villages and each village has a headman or headwoman who serves as the decision-making authority for the village and generally ensures that village life runs smoothly. The village headmen, in turn, report to community leaders. The traditional leadership are deeply respected by community members. The leadership, however, is not elected; rather, they come from particular families in the community. One of the communities, Sikaunzwe, has an agricultural committee that writes reports to the government about their agricultural situation (Sikaunzwe Focus Group Discussion, 2013).

Given the lack of rules and institutions that specifically govern community response to floods, households are quite autonomous at the operational level. In the event of a flood, one household may choose to evacuate their house and another household in the same village may choose to remain in their house; this has happened time and time again during past flooding events. This is, however, not necessarily the case if the flooding is particularly severe and the government mandates that community members evacuate their homes (Kasaya Focus Group Discussion, 2013; Sikuzu Focus Group Discussion, 2013). According to the historical data, such government-mandated evacuation has only occurred once – during the 2008 floods, some villages in Kasaya were evacuated to Kazungula town (Appendix 6).

Furthermore, as discussed earlier, disaster risk reduction and preparedness measures, i.e. flood barriers, can be considered public goods. Community members need to act collectively and pool their resources to produce these goods. According to Mancur Olson (1965, p.2):

“Unless the number of individuals is quite small, or unless there is coercion or some other device to make individuals act in their common interest, rational self-interested individuals will not act to achieve their common or group interests”.

In the case of the Zambian communities, there is no coercive mechanism, i.e. an enforceable agreement or involvement of external authority, by which community members are forced to act collectively; communities do not have flood contingency plans and the government does not require communities to take disaster risk reduction and preparedness measures. As a result, some community members choose to undertake individual actions such as building flood barriers around their household or field rather than collective actions.

Collective action problems at the operational level also exist due to power asymmetries within their communities. Communities have established power hierarchies – villages are led by headmen and communities, overall, are led by community leaders. In addition, community members that are Red Cross volunteers have higher social standing. These power asymmetries are evident during beneficiary selection and relief distribution. While beneficiaries are supposed to be chosen objectively, based on Red Cross selection criteria, this is not always the case. In the past, the Red Cross has had problems with local volunteers selecting beneficiaries that were either their family or friends. Headmen and local

community leaders can influence this selection process due to their position in their communities (ZRC Disaster Management Staff Interview, 2013). These inequities in distribution cause issues of mistrust in the communities which jeopardize future collective action initiatives (Andersson et al, 2005).

### **4.3. Economic Barriers**

All 4 communities are poor (Section 3.4.1). This is largely why community members claim that they do not have the resources for risk reduction and preparedness (Kasaya Focus Group Discussion, 2013; Sikaunzwe Focus Group Discussion, 2013; Sikuzu Focus Group Discussion, 2013; Situlu Focus Group Discussion, 2013). Community members depend on subsistence agriculture as their primary livelihood. Significant barriers include the lack of access to seeds and the dependency on maize which provides low marginal returns, provided that farmers actually produce enough to be able to sell the surplus (Sikuzu Focus Group Discussion, 2013; Holmes and Slater, 2007). In addition, they have few livelihood alternatives. Their income is therefore limited and highly dependent on climate. Poverty in the villages is also exacerbated by a lack of education. The majority of adult community members have approximately a 9<sup>th</sup> grade education. Community members have few assets, low income, a lack of skills, and livelihoods that are highly vulnerable to climate shocks. While communities are interested in preserving their livelihood and financial security over the long-term, they end up focusing their attention and resources on daily survival needs (Pomeroy et al, 2006). As stated by a female focus group participant, in the aftermath of floods, households expend the

majority of their time and resources trying to find food for their children (Sikaunzwe Focus Group Discussion, 2013). When disasters occur, they are forced to sell productive capital such as property and livestock and limit their meals from three a day to just one (Appendix 6, Sikuzu Focus Group Discussion, 2013). This poverty means that community members are dependent on government welfare and social security programs and external help from humanitarian, civil society and non-governmental organizations.

Furthermore, accessing markets is difficult. Kazungula, the closest town to Sikaunzwe, and Mwandi, the closest town to Kasaya, Situlu and Sikuzu, are still far enough that community members cannot easily reach them with the goods they want to sell in the market. As a result, community members sell their goods on the side of the main road between Kazungula and Sesheke. This is likely why switching to alternative livelihoods has been largely ineffective. There is a lack of a market for charcoal, reeds, and mats where the communities are located.

An action that community members do undertake collectively is appealing to the government for aid when a flood has occurred (Sikaunzwe Focus Group Discussion, 2013). After the 2008 floods, the Kasaya community wrote to the government asking for help (Appendix 6). Similarly, after the 2006 floods, the Sikaunzwe community appealed to the government for relief (Sikaunzwe Focus Group Discussion, 2013; Appendix 6). Community members are more inclined to participate in such collective activities because the benefit of appealing for aid and the government responding far outweighs the cost of making the appeal and the

government not responding. Conversely, community members are not necessarily willing to spend limited resources and time collectively building a flood barrier as there is no guarantee that the barrier will actually obstruct floodwaters.

#### **4.4. Normative Barriers**

A major normative barrier to adapting to floods is the dependence on traditional livelihoods such as agriculture and livestock-rearing. Agriculture and livestock-rearing are both highly flood-prone livelihoods. As it has been demonstrated, floods wash away crops, destroy fields, destroy grazing pastures, and cause livestock disease outbreaks (Appendix 6). Despite this, communities return to their traditional livelihoods once floods have passed. This dependence on traditional livelihoods is also problematic during floods. A focus group participant from Kasaya stated that they “have to go back to the river for [their] livelihood” given that their fields are located in the floodplain, along the river. Fishing, another traditional livelihood, brings people to the river during floods (Sikaunzwe Focus Group Discussion, 2013; Sikuzu Focus Group Discussion). Going back to the river during floods can be highly risky because (1) there are crocodiles in the area that have killed people, (2) flowing floodwaters can be dangerous, and (3) stagnant floodwaters can lead to disease outbreaks, i.e. malaria (Situlu Focus Group Discussion, 2013).

Furthermore, community members are hesitant to move to the higher lands during floods, even temporarily. This is partly because they do not want to leave their traditional lands. A focus group participant from Situlu stated, “I cannot agree

to go somewhere else. Even if you take us to some other places, it's not good". Others stated that leaving their lands would be "impossible" and that in previous occasions when they had moved, they quickly returned to their lands because they "felt it would be better to return to [their] lands" (Kasaya Focus Group Discussion, 2013). This hesitation to leave their traditional lands, even temporarily, exacerbates their risk during floods.

#### 4.5. Cognitive Barriers

According to Grothmann and Patt (2005), perceptions of risk greatly influence behavioural adaptations – these adaptations can be adaptive or maladaptive. In this case, the maladaptation is that people are not adequately adapting to or coping with floods (Section 3.5). Grothmann and Patt (2005, p. 206) go on to state that "cognitive biases and lack of perceived adaptive capacity" can play a role in adaptation. In Table 13, we see that household perceptions of preparedness are associated with actual preparedness, an element of adaptive capacity. As noted in Section 3.5, community members perceive that they are not prepared and do not have the capacity needed to cope with and adapt to floods. This perceived lack of capacity can cause maladaptive behaviors and reduce adaptation intention. In Kasaya, Sikaunzwe, Situlu and Sikuzu, maladaptive responses (i.e. not adapting to floods) include the avoidant reactions of fatalism/helplessness and wishful thinking (Grothmann and Patt, 2005).

Hypothesis	Statistical test	Test result	Implication
Household preparedness is	Chi-squared	Pearson chi-squared = 10.7259	The null hypothesis household preparedness

associated with belief that being prepared will/will not help family in emergency situations		<b>Pr=0.030*</b>	is not associated with belief that being prepared will/will not help family in emergency situations is rejected
Household preparedness is associated with perception of household's preparedness to handle a disaster	Chi-squared	Pearson chi-squared = 16.3182 <b>Pr=0.038*</b>	The null hypothesis household preparedness is not associated with perception of household's preparedness to handle a disaster is rejected
Household preparedness is associated with perception of family's current ability to handle a disaster compared to last year	Chi-squared	Pearson chi-squared = 22.11000 <b>Pr=0.001*</b>	The null hypothesis household preparedness is not associated with perception of family's current ability to handle a disaster compared to last year is rejected

**Table 13. Statistical tests conducted to gauge associations between perceptions of preparedness and actual preparedness at the household level. Test results significant at the p=0.05 alpha level are bolded and starred.**

During the focus group discussions, community members expressed feelings of helplessness and fatalism. Focus group participants made statements such as “we have tried by all means to take reports to the government saying please the water will kill us”, “there is nothing we can do”. Community members feel that dealing with the flood is not within their capacity and that they require external help to survive. Community members also stated, “We have prayed, but we have failed”, when asked how they have prepared for or reduced their risk to floods in the past. Community members are deeply religious and attribute the consequences of floods to ‘God’s will’.<sup>12</sup> Therefore, individuals think there is little sense in taking disaster

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<sup>12</sup> While communities historically practiced local religions, missionary activities throughout the 1900s (and even now) have caused most Zambians to convert to Christianity.

risk reduction initiatives. Rather, what will happen will happen and there is no way of mitigating it or adapting to it.

There were also indications of wishful thinking. A focus group participant from Sikaunzwe stated:

“The elders try and tell the community and some will move to the upper land, but you find that those that are younger still plant in the lower lands and if the floods come, they will wipe away all their crops.”

The younger generation seem to be planting crops in the lower lands despite warnings from the elders. While it might be that the benefit of planting in the lower lands and harvesting a good yield outweighs the risk of planting in the lower lands and losing crops to a flood, the younger generation are still making decisions based on hopes and desires over the reality of recurring floods.

Existing perceptions of preparedness and avoidant reactions partly result from the lack of knowledge about how to cope with and adapt to disasters.

#### **4.6. Knowledge Barriers**

Missing information prevents communities from effectively arriving at solutions for collective action problems (Andersson et al, 2005). Community members associate disaster risk reduction and preparedness with a high cost. For example, approximately 54% of baseline survey respondents stated that their households were less able to handle a disaster as compared to last year. The most common reasons given for this were: (1) cost of living has increased, (2) loss of job or income source, and (3) reduced earnings. Although floods are recurring, there is no certainty that they will occur in a particular year, making it difficult for



communities to justify spending their scarce monetary resources. This was supported in the focus group discussions where participants stated that traditional forecasts were unreliable and that they did not have any resources to prepare for disasters (Kasaya Focus Group Discussion, 2013; Sikaunzwe Focus Group Discussion, 2013; Sikuzu Focus Group Discussion, 2013; Situlu Focus Group Discussion, 2013). Community members, therefore, feel that they are too poor to cope with disasters. While poverty can inhibit preparedness, communities have access to common-pool resources (i.e. wood and sand), skills (i.e. woodwork, sewing, construction) and other capacities (i.e. manpower) that can be used to implement low-cost disaster risk reduction and preparedness measures.

Part of this misperception is because individuals simply do not know what disaster risk reduction and preparedness entail. For example, 52.1% of baseline survey respondents stated that their households were not prepared to handle an upcoming disaster, 42.9% claimed to be somewhat or very prepared, and 5% did not know how prepared their households were. Of those respondents who claimed that their households are very or somewhat prepared to handle disasters, many did not have supplies they perceive can be used in emergency situations and/or had not spoken about or planned for what to do if a disaster occurs. Communities have not been adequately sensitized about natural disasters as evident from the lack of community participation in disaster risk reduction and preparedness initiatives and involvement of external agencies such as the government and other NGOs and civil society organizations (Table 14). The involvement of external agencies is with

household-level preparedness, particularly in situations where households have been visited by external agencies to talk about disasters (two-way chi-squared,  $\chi^2 = 12.3818$ ,  $p < 0.05$ ) and where households have participated in a community or volunteer activity related to disaster risk reduction or preparedness (two-way chi-squared,  $\chi^2 = 11.7749$ ,  $p < 0.05$ , Table 15). Household and community preparedness is negatively affected by the lack of external involvement because there is then no social learning process by which communities interact with external agencies to integrate scientific and traditional knowledge to develop low cost, contextually-relevant disaster risk reduction and preparedness measures (Mercer et al, 2010). External involvement alone, however is not enough; external agencies need to adequately incentivize community participation in their initiatives.

% HH that have....	Kasaya	Sikaunzwe	Sikuzu	Situlu
attended a meeting on how to be better prepared for a disaster in past year	13.79%	14.29%	10%	26.09%
attended a First Aid training in past year	0%	3.57%	0%	0%
participated in a disaster/evacuation drill in past year	10.34%	3.57%	0%	4.35%
participated in a community/volunteer activity related to disaster preparedness/prevention in past year	3.45%	5.36%	0%	4.35%
had a person visit their home to talk about disasters in the past 6 months	6.90%	3.57%	0%	13.04%
received information on disasters from media sources	3.45%	19.64%	0%	8.70%
received a pamphlet/flyer about disasters in the past 6 months	0%	5.36%	0%	8.70%
received information on disasters from a government source in the past 6 months	3.70%	14.29%	0%	4.35%
received information on disasters from other sources (i.e. family, friends) in the past 6 months	0%	16.07%	0%	0%

**Table 14. Household participation in community-level preparedness and risk reduction initiatives.**

Hypothesis	Statistical test	Test result	Implication
Household preparedness is associated with attendance at meeting on how to be better prepared for a disaster	Chi-squared	Pearson chi-squared = 3.6180 Pr=0.460	The null hypothesis household preparedness is not associated with attendance at meeting on how to be better prepared for a disaster cannot be rejected
Household preparedness is associated with participation in a disaster or evacuation drill	Chi-squared	Pearson chi-squared = 1.6940 Pr=0.792	The null hypothesis household preparedness is not associated with participation in a disaster or evacuation drill cannot be rejected
Household preparedness is associated with attendance at a First Aid training	Chi-squared	Pearson chi-squared = 4.8246 Pr=0.090	The null hypothesis household preparedness is not associated with attendance at a First Aid training cannot be rejected
Household preparedness is associated with participation in a community or volunteer activity related to disaster risk reduction or preparedness	Chi-squared	Pearson chi-squared = 12.3818 <b>Pr=0.002*</b>	The null hypothesis household preparedness is not associated with participation in a community or volunteer activity related to disaster risk reduction or preparedness is rejected
Household preparedness is associated with household visit by external agency/individual to talk about disasters	Chi-squared	Pearson chi-squared = 11.7749 <b>Pr=0.019*</b>	The null hypothesis household preparedness is not associated with household visit by external agency/individual to talk about disasters is rejected
Household preparedness is associated with having received a pamphlet/flier about disasters	Chi-squared	Pearson chi-squared = 2.6551 Pr=0.617	The null hypothesis household preparedness is not associated with having received a pamphlet/flier about disasters cannot be rejected
Household preparedness is associated with having received information on disasters from the media	Chi-squared	Pearson chi-squared = 0.6860 Pr=0.710	The null hypothesis household preparedness is not associated with having received

			information on disasters from the media cannot be rejected
Household preparedness is associated with having received information on disasters from a government source	Chi-squared	Pearson chi-squared = 1.0194 Pr=0.907	The null hypothesis household preparedness is not associated with having received information on disasters from a government source cannot be rejected
Household preparedness is associated with having received information on disasters from any other sources	Chi-squared	Pearson chi-squared = 1.9013 Pr=0.754	The null hypothesis household preparedness is not associated with having received information on disasters from any other sources cannot be rejected
Household preparedness is associated with government involvement in projects/activities related to reducing disaster risk/vulnerability	Chi-squared	Pearson chi-squared = 2.3224 Pr=0.677	The null hypothesis household preparedness is not with government involvement in projects/activities related to reducing disaster risk/vulnerability cannot be rejected
Household preparedness is associated with access to government resources/programs for disaster response and/or recovery	Chi-squared	Pearson chi-squared = 7.5130 Pr=0.111	The null hypothesis household preparedness is not associated with access to government resources/programs for disaster response and/or recovery cannot be rejected

**Table 15. Statistical tests conducted to gauge associations between the involvement of external agencies in communities and actual preparedness at the household level. Test results significant at the  $p=0.05$  alpha level are bolded and starred.**

Not only is there poor participation in the few existing initiatives, there is inconsistency in household knowledge about existing community-level initiatives (Table 14). One household in a village will claim that the government is involved in their community while another household in the same village or a nearby village will answer ‘no’ or ‘don’t know’ to the same question (Table 11 and Table 14). This

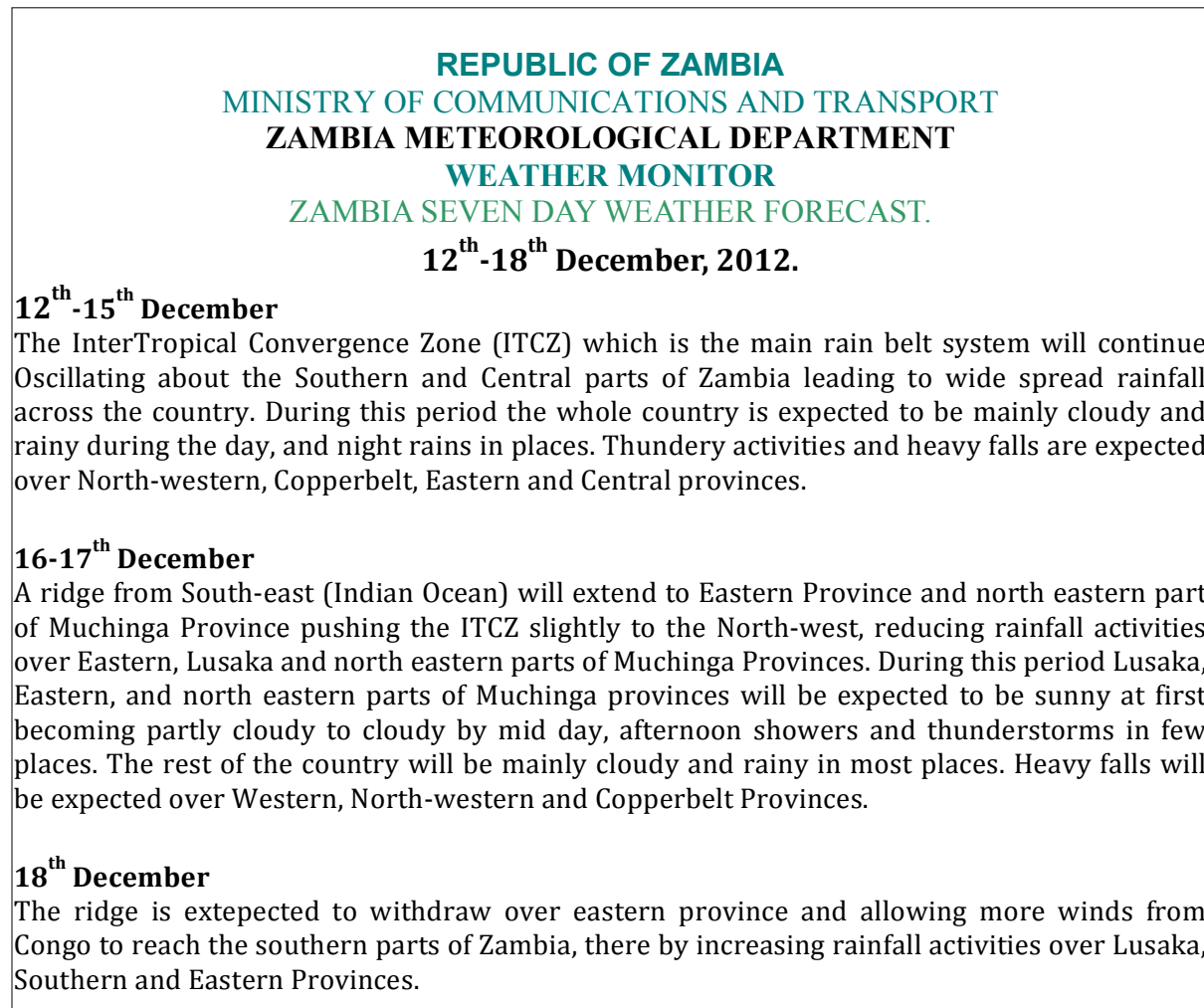
shows that information about risk reduction and preparedness and related initiatives are not being disseminated appropriately across communities. Inconsistencies between households makes the community less prepared and resilient as a whole.

The information/knowledge needed by communities does not only include short-term preparedness and risk reduction strategies. A focus group participant stated that her community did not know how to manage their rangelands. Decades of deforestation to make way for fields have resulted in soil degradation and in turn exacerbated flood risk (Sikaunzwe Focus Group Discussion, 2013). Therefore, the knowledge required by these communities includes longer-term natural resource management which will help communities adapt to flood risk and improve their overall vulnerability.

Another informational deficit lies within the lack of community access to scientific forecasts. While communities do have traditional forecasting methods, many community members perceive traditional forecasts to be unreliable and inaccurate (Kasaya Focus Group Discussion, 2013; Sikaunzwe Focus Group Discussion, 2013; Sikuzu Focus Group Discussion, 2013; Situlu Focus Group Discussion, 2013). In the baseline survey, 76.3% of respondents claimed that they had never received a scientific forecast. Of those who did receive forecasts, 35% stated that they did not use the forecasts due to (1) lack of knowledge about the forecast, (2) prefer to wait for a situation and act accordingly, and (3) unsure about forecast reliability.

Problems with forecast reliability and lack of knowledge about forecasts can be considered principle-agent problems where the principle is the community and the agent is the forecast provider; while forecast providers have greater information about the forecast (i.e. likelihood of occurrence, what the forecast means), deterministic communication of the forecasts to forecast users means that information is missing (Patt and Gwata 2002; Andersson et al, 2005; Roncoli et al, 2009). Figure 16 shows an example of a 7 day weather forecast provided by the Zambian Met via email. While communities cannot access these specific forecasts, it is representative of the type of information disseminated by the Zambian Met to the public via radio, newspapers, TV, and email. The forecast has a number of issues. First, it is not downscaled enough. A forecast for the Southern Province cannot be used with great reliability or accuracy to make forecast-based decisions in Kasaya or Sikaunzwe. Second, it uses terminology and concepts, i.e. Intertropical Convergence Zone, that cannot necessarily be understood by people who have not learned about it. Third, it does not state how much rain is actually expected. Rather, it says 'heavy falls'. Are these heavy falls heavy in the sense that they are good for crops or in that they will cause floods and destroy crops? Fourth, it does not give any indication of forecast uncertainty. What is the likelihood of heavy rains occurring? Is the likelihood high enough that early actions should be taken? Fifth, the forecasts are point-forecasts. While these forecasts may be useful for understanding if heavy rains will cause on-location floods, they are not useful for predicting floods caused by heavy rains in upstream areas. Forecasts and warnings

need to be credible, salient, and legitimate and they need to be packaged in ways that are understandable and useful to communities (Dilling and Lemos, 2011; Cash et al, 2006; Patt and Gwata, 2002; Roncoli et al, 2009).



**Figure 16. Sample 7 day forecast provided by the Zambian Met via email.**

#### **4.7. Technological Barriers**

Communities have the greatest difficulties with floodwater obstruction and floodwater harvesting. In terms of floodwater obstruction, community members have attempted to build ridges and dig furrows/drainages in the past. However, the ridges have been washed away and the furrows have been overwhelmed on several

occasions (Kasaya Focus Group Discussion, 2013). In addition, communities are unable to harness floodwaters to use for the rest of the year. In Sikaunzwe, a focus group participant from Sikaunzwe stated that her community was storing rainwater in 210 liter pits left behind by contractors involved in the construction of Nakatindi road. These pits cannot store enough water for a month. In addition, existing dams dry out quickly. This becomes deeply problematic during the dry season. Focus group participants suggested digging a series dams in their communities that could both obstruct floodwaters from reaching fields and homes and harvest water that communities can use for the rest of the year. The problem, however, is that they do not have the technological know-how or the resources to go about digging those dams.

Another technological barrier in these communities is the lack of an early warning system. Community members expressed that traditional methods of forecasting are unreliable and therefore largely unused. Early warnings and forecasts disseminated by the Zambian Met are not particularly useful, as discussed above. In addition, these forecasts are difficult to access due to the poor radio and cellphone networks in the communities. Community members reported getting clearer Namibian radio signals over Zambian radio signals (Kasaya Focus Group Discussion, 2013; Sikaunzwe Focus Group Discussion, 2013; Sikuzu Focus Group Discussion, 2013; Situlu Focus Group Discussion, 2013). An early warning system which provides credible, reliable and legitimate warnings will help communities take action in anticipation of a hazard.



#### **4.8. Physical/Natural Barriers and Limits**

Temporary shifting from lower lands to upper lands for shelter has been challenging for many households because their fields and homes are located in the lower lands. The temporary shift puts cultivation on hold as cultivation in the upper lands is difficult due to water availability and sandy soils. Soil is much more fertile nearer the river (Kasaya Focus Group Discussion, 2013; Sikaunzwe Focus Group Discussion, 2013).

In addition, when they shift, they have to take their livestock with them which can be very difficult, especially when the household has a lot of livestock. As a result, many households are hesitant to evacuate their homes, even temporarily. Leading livestock from lower lands to upper lands on a daily basis for grazing pastures has also been challenging for households (Kasaya Focus Group Discussion, 2013). Shifting to higher grounds is also unfeasible, especially in Kasaya and Sikaunzwe, because there is a lack of water in the upper lands (Kasaya Focus Group Discussion, 2013; Sikaunzwe Focus Group Discussion, 2013).

Furthermore, Kasaya, Sikaunzwe and Sikuzu are above a salt water aquifer. Therefore, boreholes and wells cannot be used. These communities are therefore dependent on rivers for daily water needs and in many instances, these rivers are far away from villages. The salt water also makes it difficult for community members to keep gardens (Sikuzu Focus Group Discussion, 2013). Existing wells (in areas without salty water) have become quickly clogged with sand (Situlu Focus

Group Discussion, 2013). Otherwise, wells dry out quickly during the dry season (Sikaunzwe Focus Group Discussion, 2013).

A major issue is the soil degradation around the river that has been caused by the clearing of trees to make way for agricultural fields. The degradation means that loose soil is dragged into the water when floodwaters recede. As a result rivers, in parts, have become shallower overtime and are more likely to flood during heavy rains (Sikaunzwe Focus Group Discussion, 2013).

Sikaunzwe focus group participants also stated that water would come through cracks in the ground. They stated that they had tried to fix the cracks, but had been unsuccessful in doing so. They seem to be referring to water coming out of the ground when water table levels get very high. Ridges and drainages cannot obstruct this water from entering fields and homes (Sikaunzwe Focus Group Discussion, 2013).

Furthermore, floods can be preceded by dry spells or droughts. The crop failures resulting from the droughts make it difficult for households to prepared for upcoming floods.

#### **4.9. Conclusion**

The different types of barriers interact to prevent households and communities from adapting to floods. Political barriers have led to institutional, economic and knowledge barriers. Institutional barriers have also contributed to knowledge barriers by way of information asymmetries across different scales of interactions (ZRC-community, government-community, community-community).

Knowledge barriers have led to cognitive barriers. Normative barriers such as the dependence on traditional, but flood-prone, livelihoods and physical/natural barriers and limits have further exacerbated poverty and, therefore, economic barriers to adaptation. Finally, poverty and a lack of access to technology (due to marginalization) means that there are also technological barriers to adaptation. These barriers, especially institutional and knowledge barriers, disincentivize communities from adapting to floods. These barriers to adaptation can be used to explain why communities have been unable to reduce their sensitivities and improve their adaptive capacities to floods.

## CHAPTER V

### **The Utility of the VCA**

#### **5.1. VCA Objectives**

The IFRC defines the VCA as a “participatory investigative process” by which risks and vulnerabilities to hazards and capacities to cope with those hazards can be assessed (IFRC, 2007a, p. 6). By identifying risks, Red Cross National Societies can assist vulnerable communities in reducing their risks by utilizing local skills, knowledge and initiative. Overall, the goal of the VCA is to help vulnerable populations better prepare for hazards and mitigate their impacts and in turn avert disasters.

The VCA action-research framework has 4 components (1) research/identify problems, (2) develop solutions, (3) implement projects, and (4) evaluate and modify solutions (IFRC, 2007a). The VCA should be conducted before disaster risk reduction and preparedness solutions are developed. However, this is not often case. In terms of the ZRBI, for example, the Red Cross decided that community-based early warning systems needed to be implemented before the VCA was conducted and analyzed. This largely occurred due to the funding process; the Red Cross had to provide donors with a project proposal detailing specific goals, expected outcomes, a budget, and a timeline in order to acquire funding. The Red Cross could not consult with communities during this process as they did not have project-specific

funds and did not want to make promises to communities about a project that may not ultimately get funded. Therefore, the ZRBI, despite its focus on community engagement, was planned without community input and lists preparedness measures (i.e. early warning systems) that communities should implement without knowing whether these measures are community appropriate. Communities have relatively little say in the design of specific project goals which brings into question the participatory nature of the VCA. It also brings into question the necessity of conducting the VCA given that vulnerabilities, risks and capacities were assumed in the ZRBI before the VCA was even conducted.

Initiatives like the ZRBI require community engagement. First, involving local people in mitigation initiatives is a major component of building resilience (Norris et al, 2008). Communities should be encouraged to act collectively to promote innovation and strengthen social networks, information-sharing, and social learning, especially in the face of poor institutions. Second, communities have firsthand knowledge about their vulnerabilities (Blaikie et al, 1994; Gaillard et al, 2007; Wisner, et al 2004). This Red Cross needs this information so that they can monitor the success of ZRBI activities overtime. Third, community experience with disasters means that they know how disasters manifest locally and what responses have and have not worked in the past (Mercer et al, 2009). This information will help the Red Cross design appropriate community-based risk reduction and preparedness activities. Fourth, the ZRBI aims to implement community-based programs and solutions such as early warning systems which require the

participation of community members for the purposes of implementation, information dissemination, monitoring, and maintenance. Community engagement will build local ownership of the ZRBI. While the ZRBI is expected to be phased out in 2017, project goals need to be sustained beyond this period to ensure that communities continue to become more resilient to climate change and variability. Community ownership will incentivize communities to sustain project goals in the long-term, and eventually institutionalize project goals within the communities (Andersson et al, 2005). However, considering that ZRBI planning did not involve community input, communities may not feel like they have ownership over the project. Therefore, the lack of community engagement could mean the failure of the VCA and related initiatives like the ZRBI.

## **5.2. The Research Process**

The 'VCA toolbox' contains a list of quantitative and qualitative tools that can be used to conduct successful VCAs. These tools include: (1) review of secondary sources (written reports and documents, preferably about the communities in question), (2) baseline survey, (3) semi-structured interview, (4) focus group discussion, (5) direct observation, (6) participatory mapping, (7) transect walk to identify risk, vulnerability and capacity in the most risk prone areas, (8) seasonal calendar, (9) historical profile, (10) household/neighborhood vulnerability assessment, (11) livelihoods/coping strategy analysis, (11) social network analysis, (12) community organization analysis, and (13) Venn diagram. Any combination of

these tools can be chosen to conduct the VCA. The tools chosen are heavily influenced by funding and the National Society's capacity.

The VCA guidebook details exactly how these tools should be used, i.e. what information is sought, how they should be designed, how they should be conducted and how they should be analyzed (IFRC, 2007a). In this sense, the VCA is not flexible to accommodate different research needs. It is very much a management-oriented research tool. In addition, this inflexibility means that alternative conceptions of vulnerability, capacity, preparedness, institutions, etc cannot be used. This is especially the case for structured surveys such as the baseline survey.

In most situations, Red Cross volunteers are trained by Red Cross staff to conduct parts of the VCA, i.e. the baseline survey, historical data collection, transect walks, interviews. Red Cross staff do not conduct the full VCA themselves (IFRC, 2007b; IFRC, 2008b). This is beneficial for a number of reasons. For one, community members are more likely to speak honestly with local volunteers than with Red Cross staff that they are unfamiliar with. Two, local volunteers already know their communities, and therefore planning the logistics of conducting surveys and questionnaires will take less time (i.e. where are the villages, how do we get there, etc). Three, by designating tasks across a larger number of people, the VCA can be completed more quickly. Four, by training volunteers how to conduct VCAs, communities are being given greater ownership of the VCA and resulting initiatives/projects.

However, this dependence on volunteers is also problematic for a number of reasons. First, in communities where the training facilitators need to utilize translators, a lot may be lost in translation during the training, leading to misunderstanding and poor data collection. Second, if 10 volunteers are designated to conduct baseline surveys, it is likely that baseline surveys will be conducted in 10 different ways, given differences in understanding, perceptions, and styles of asking and explaining questions. Interviewer error is difficult to control for. Third, the reliance on volunteers prevents Red Cross staff from fully engaging with the communities (by walking through, talking to different people, etc) and therefore limits the extent to which they can familiarize themselves with the communities. This is likely to be problematic when it comes to analyzing the VCA and generating and implementing solutions as the staff may not be familiar enough with the local context.

### **5.3. Assessment of Vulnerability and Capacity**

Here, I use the Turner et al (2003a) and Jones and Boyd (2011) frameworks to evaluate the VCA's role in understanding vulnerability. The Turner et al (2003a) framework provides an integrated approach to vulnerability analysis in its treatment of systems as coupled human-environment systems, where social and environmental subsystems interact in the context of external influences. This framework, however, does not address how vulnerabilities are caused and why they exist. The Jones and Boyd (2011) framework sheds some light on the mechanisms of vulnerability given its focus on factors that limit adaptive capacity and hinder



adaptation. I will additionally evaluate the VCA's consideration of cross-scalar political factors. Neither of the frameworks adequately account for political factors that affect adaptation and vulnerability.

The VCA process does not treat systems as coupled human-environment systems given that it cannot be used to identify the environmental conditions that contribute to hazard sensitivity, i.e. the biophysical endowments. The hazards maps and the questions in the baseline survey, historical data collection, and the focus group discussions do not focus on biophysical endowments. While the focus group discussions revealed some issues such as soil erosion exacerbating flood risk and changes in seasonal temperature and rainfall patterns, these claims could not be confirmed. The VCA is more adept at measuring the social endowments that contribute to hazard sensitivity.

The VCA is also unable to reconcile different scales of vulnerability. Aggregated household vulnerabilities should reflect overall community vulnerability (Morrow, 1999; Moore et al, 2004). However, when assessing vulnerability, it became clear that the aggregated baseline survey data did not always map onto vulnerability expressed during the focus group discussions. For example, statistical analysis suggested that educational attainment was not associated with household-level flood sensitivity, whereas, the focus group discussions attested to the importance of education for coping with disasters (Table 5). Focus group participants stated that they needed education to learn skills, how to manage their rangelands and how to use forecasts (Sikaunzwe Focus Group

Discussion, 2013). This discrepancy between the household-level data and focus group discussions indicates that the baseline survey is not able to fully identify vulnerabilities. Part of the problem may be the structured format of the baseline survey where questions were posed in multiple-choice format. On one hand, the structured format allows for the data to be used quantitatively and allows for the baseline survey to be repeatedly conducted and compared in order to keep track of changes in socio-economics, perceptions, preparedness and capacities over a long period of time. On the other hand, such a format prevents the interviewer from delving into the nuances of people's thoughts, beliefs and perceptions.

In addition, the baseline survey makes a lot of assumptions as to what constitutes as vulnerability and capacity. Assets, for example, were evaluated based on whether households owned a radio, TV, clock/watch, axe, mobile phone, bicycle, sewing machine, jewelry, car, motorbike, and/or refrigerator. These 'assets', as defined by the Red Cross, may not actually be valuable or available in these communities. Furthermore, they might not be representative of the full range of assets considered valuable by community members. In this sense, the assets chosen by the Red Cross may not be reliable representation of household wealth. Similarly, the baseline survey also makes assumptions as to what preparedness entails at the household level; the questions focus on whether or not households have made/discussed a disaster plan and household participation in preparedness activities organized by internal and external agencies. Furthermore, the baseline survey's conception of forecasts is limited to scientific forecasts – traditional

forecasts (i.e. the presence of cobwebs which indicate heavy rains) are ignored. It is possible that community members define preparedness differently to the Red Cross. It may, for example, include having social networks that individuals and households can rely on during emergencies and/or a reliable traditional forecasting system. Therefore, the baseline survey may not be capturing the actual vulnerabilities experienced by and the capacities present in households. Conversely, the more open structure of focus group discussions allows community members to explain their experiences based on their definitions of vulnerability and capacity. This is potentially a partial cause of the discrepancy between the results of the baseline survey data and focus group discussions.

This discrepancy also brings into question whether quantitative data can truly map onto qualitative data. In quantitative data analysis, hypotheses are tested to determine the statistical significance of relationships (or associations or correlations). Significance is usually tested at the 0.05 alpha level. This alpha level has been controversial. First, it measures the extent to which the observed result can be due to chance rather than the chance that a hypothesis is correct. Therefore, a p-value cannot determine causality. Second, 0.05 is an arbitrary number. Numerous results have been discounted because they have not met the 0.05 alpha level condition for statistical significance. Should associations with p-values greater than yet close to 0.05 (i.e. 0.06, 0.07) be discounted entirely? Third, given that such statistical testing is only able to test correlations, it is possible that highly implausible hypotheses can have statistically significant results (Nuzzo, 2014). It

must be noted, however, that I conducted simple tests of associations which do not produce confidence intervals or signal the direction of an effect. For example, a Wilcoxon-Mann Whitney test will not tell me if agricultural dependence increases or decreases household sensitivity to floods. It is likely that a logistic regression with multiple dependent variables would have greater statistical and explanatory power due to its ability to measure the relative strengths of effects of dependent variables on an independent variable via confidence intervals and effect sizes (Nuzzo, 2014). Therefore, it would be beneficial to generate logistic regressions to determine the effects of different indicator variables (i.e. education, gender, wealth, etc) on a dependent variable (i.e. sensitivity).

Furthermore, the closed-structure of the baseline survey and the consequent difficulty in capturing nuance in risk experiences and perceptions means that there were few differences across Sikaunzwe, Kasaya, Sikuzu and Situlu. The households across the communities answered the questions in similar ways and were therefore similar in terms of vulnerability, preparedness, and capacity. It may be the case that these communities are similar given their proximity, cultural, social, economic, and political similarities. However, it may also be that the baseline survey does not capture existing differences. While the focus group discussions should ideally capture these nuances, their open structure meant that the discussions were varied. In Sikaunzwe, participants spoke of the challenges faced by women, whereas, in Sikuzu, participants stressed the need for seeds. This does not mean that access to seeds is not a problem in Sikaunzwe or that women are less vulnerable in Sikuzu.

In addition, the VCA is not designed to understand why community vulnerabilities exist. Political ecologists maintain that vulnerability is caused by inequalities arising from historical and existing political, legal and institutional structures; yet, it is difficult to identify these underlying causes of vulnerability using the VCA alone. While the VCA toolkit does provide some tools for institutional analysis (i.e. social network analysis, Venn diagram), it is evident that the IFRC's conception of an institution is narrow. The institutions considered are local organizations (e.g. Sikaunzwe's Agricultural Committee) and the analysis is limited to assessing "people's perceptions of the role and significance" of these organizations within their communities (IFRC 2007a, p.21). The VCA, therefore, did not allow me to engage with external political economy and political climate during data collection. Part of the reason for this is the Red Cross' principle of neutrality. The principle of neutrality states that humanitarian organizations should remain politically neutral meaning that they cannot enforce their own political interests or external political interests in their activities (IFRC and ICRC, 1995; Pictet, 1979). In terms of disaster response, the expectation is that the Red Cross can then ensure that the benefits of humanitarian responses and initiatives are distributed equitably across vulnerable, hazard-prone communities. In addition, the National Societies are auxiliary to their respective governments, and are therefore responsible for upholding government policies. This is reflected in the VCA process where questions about external institutions, politics and political economy are avoided. While community marginalization can be assumed given poverty levels and

lack of government involvement in the communities, the underlying causes of marginalization cannot be parsed out. The problem arises from the fact that vulnerability cannot be isolated from the broader political economy and the institutions in which it exists (Adger, 2006).

A final issue in the assessment of vulnerability and capacity using the VCA is that of respondent bias. It is possible that baseline survey respondents, historical data respondents, and focus group participants were not providing accurate answers. The Red Cross, after all, is a humanitarian organization that is known for providing relief. A focus group discussion participant stated (Sikuzu Focus Group Discussion, 2013):

“From what we know, the Red Cross likes to help. When you go to Namibia, you find that people, they rely too much on the Red Cross. So now when we see you here, now we are what? You have come to help us. Our needs are now in your hands”.

Community members did state on numerous occasions that they had no resources with which to cope with and adapt to disasters. It is unclear if this is really case and if this ‘perceived’ lack of resources can largely be attributed to not knowing what preparedness entails. Furthermore, communities have managed to survive despite recurring floods, suggesting that their coping capacities are not so low after all. If community members were exaggerating their risk exposure, sensitivity and inability to cope, then their actual vulnerability and capacity cannot be assessed.

#### **5.4. VCA Use and its Implications**

Currently, the VCA follows the Science Push model of knowledge production where the information agenda is set by the Red Cross (Dilling and Lemos, 2011).

The Red Cross utilizes its definitions and measures of vulnerability and capacity to assess communities. These generalized conceptions of vulnerability and capacity are developed in Geneva, in the Red Cross headquarters, and do not entirely accommodate the nuances that arise from differences in social, economic, political, and ecological contexts. This will be problematic because vulnerability and capacity will not be accurately assessed, making it difficult to design and implement locally relevant disaster risk reduction and preparedness measures. This is evident in the discrepancies between the baseline survey results and the focus group discussion data. In addition, the Science Push model can set a precedent of community exclusion from Red Cross activities and therefore make community members feel like they have less ownership of Red Cross sponsored projects such as the ZRBI which require community engagement to be successful over the long-term.

Consequently, this variety of ‘situated knowledges’ needs to be acknowledged by co-producing knowledge (Haraway, 1998). In the context of the VCA, this means involving communities in the design of the VCA. The IFRC’s recommendation that researchers review secondary sources, i.e. reports or documents about the communities, prior to beginning VCA fieldwork is not sufficient (IFRC, 2007a). For one, reports on Sikaunzwe, Kasaya, Sikuzu and Situlu do not exist (or are difficult to access). Two, such reports are not likely to cover issues of vulnerability and capacity in the face of climate hazards. If they did, then there would be no reason to conduct a full VCA. Therefore, it is vital that researchers visit and spend time in the communities that they want to conduct the VCA in to gauge community definitions

of vulnerability, preparedness, capacity, and so on before the VCA is designed and conducted. This will ensure that the VCA tools used are designed in ways that are relevant in the local context. Community involvement does not mean that communities dictate the VCA process. If this were the case, then knowledge production would follow the Demand Pull model and run the risk of discounting the Red Cross' goals, objectives, and capacities (Dilling and Lemos, 2011). Rather this is a collaborative initiative where the Red Cross and communities share information on goals, objectives, definitions, concepts and research design.

In addition, the VCA cannot be used to solve (or challenge) the underlying causes of vulnerability i.e. poor institutions, marginalization, underdevelopment. Berkes (2007) states that vulnerability can be reduced by building resilience. In order to build resilience, (1) communities need to learn to live with variability, change, and uncertainty, (2) ecological, social and political systems need to be diversified to increase options and reduce risk, (3) learning and problem-solving needs to be encouraged, and (4) opportunities for self-organization must be created by improving local institutions and building networks across scales. O'Brien et al (2006) and Berman et al (2012) emphasize the importance of changing institutional structures and enhancing governance for managing climate risks. Thomalla et al (2006) emphasize the importance of facilitating learning and knowledge exchange, both of which need to be institutionalized, and cannot occur effectively in a system where governance and decision-making are top down. The Red Cross' neutrality principle makes it difficult for researchers to identify institutional shortcomings



using VCA data and for the Red Cross to engage in the institutional change necessary to fundamentally reduce community vulnerability to natural hazards.

Realistically, the VCA can be used to implement 'soft' solutions such as early warning systems, designating shelters, and planning evacuation routes given its focus on identifying disaster risk reduction and preparedness systems in place. While these solutions may not profoundly reduce community vulnerability and poverty, they will help protect individuals from the immediate impacts of floods (i.e. loss of life and property). If the Red Cross works to enhance community engagement in and ownership of the VCA and consequently initiatives like the ZRBI through the co-production of knowledge, community-based disaster risk reduction and preparedness activities can be sustained over the long-term. This will increase the capacity of communities to cope with hazards. The VCA can be conducted repeatedly over the long-term to evaluate if the implemented solutions are improving the coping capacities of communities with regards to floods.

## CHAPTER VI

### Conclusions

Communities in the Zambezi River Basin are vulnerable to floods, based on their exposure, sensitivity and resilience. Communities are exposed to floods due to their location and livelihood activities in the Zambezi River Basin. Communities are sensitive to floods due to poverty, lack of education, dependence on agriculture, household construction quality, poor infrastructure, and lack of access to potable water. Particularly vulnerable groups in the community include women, children, and the elderly. Communities have low adaptive capacity to floods, evidenced by their lack of preparedness, their inaction during floods, and their lack of capacity to cope with floods. What became evident was that the barriers to adaptation were also the causes of sensitivity and low adaptive capacity (or resilience). Poverty, institutions, and limited access to knowledge and technology have led to vulnerability and prevent households and communities from adapting to floods. Therefore, the barriers to adaptation and the causes of vulnerability are not mutually exclusive.

My research found that the most pertinent barriers to adaptation in the four communities are the institutional and knowledge barriers. The exclusion of these 4 communities from humanitarian and government decision-making has prevented social learning and co-production of knowledge, led to poor institutions and

consequently disincentivized individuals from these communities from acting collectively to enhance community resilience to floods. These barriers to adaptation exist in the context of Zambia's and Barotseland's contentious political history which has left much of the Western Province and part of the Southern Province underdeveloped and ignored.

My research also found that initiatives aimed at enhancing community resilience over the long-term require communities to act collectively, especially in the face of weak institutions. At the community-scale, this would involve individuals cooperating to determine how assets should be used and innovate disaster risk reduction and preparedness strategies. Beyond the community-scale, this would involve communities cooperating with the Red Cross, government, and civil society/non-governmental organizations for joint ownership of disaster management projects (i.e. ZRBI) and joint decision-making (Roberts, 2006; Bijman and Doorneweert, 2008; Burress and Cook, 2010). Such a partnership embodies a knowledge network.

The VCA helps elucidate the types of risks faced by communities, the perceptions of those risks, socio-economic characteristics that indicate vulnerability, the impacts of natural disasters, perceptions of household and community and preparedness to cope with disasters, the involvement of external agencies in communities, and the systems communities have in place to cope with hazards. However, the VCA has limited use on its own to determine the mechanisms of vulnerability. Rather, researchers need to depend on secondary sources such as

government documents about institutions and peer-reviewed studies about political histories and make connections between local vulnerabilities and historical and current political factors. The VCA process needs to be redesigned so that Red Cross National Societies conducting VCAs are required to engage with and challenge political discourses that cause vulnerability in select groups of people.

This is needed to fulfill the stated objectives and goals of the ZRBI. The VCA protocol also needs to be redesigned to allow for knowledge co-production between communities and the Red Cross. This will ensure that VCAs are designed for specific communities and Red Cross objectives. Consequently, the Red Cross will be able to collect information and generate solutions that are based on local conceptions and experiences of vulnerability and capacity.

Going forward, my research seeks to contribute to critiques of measuring vulnerability using standardized methods and indicators and make a case for the development of more adaptive methods for measuring vulnerability. These methods need to be participatory and allow for knowledge to be co-produced between the different stakeholders. Furthermore, conceptual frameworks of vulnerability in the social-ecological research tradition need to incorporate political ecology to account for the political, historical, and scalar dimensions of vulnerability. Current frameworks and resulting methods are lacking in their consideration of these elements of vulnerability. This makes it challenging to understand the underlying mechanisms of vulnerability and consequently for disaster management agencies to

design initiatives that decrease overall vulnerability to environmental or social shocks.

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# Appendix

## Appendix 1 – Baseline Survey

Date:

Community:

Village:

Household ID:

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### READ CONSENT SCRIPT

Do you agree to be interviewed? ☐ Yes ☐ No

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**READ ALOUD:** I would like to begin the interview by asking some questions about you and your household.

1. What is your gender? ☐ Male ☐ Female

2. What is your age? \_\_\_\_\_

3. What is your relationship to the head of the household?

- ☐ Head ☐ Spouse ☐ Son/daughter ☐ Spouse of child ☐ Grandchild  
☐ Father/mother ☐ Grandchild ☐ Brother/sister ☐ Father/mother-in-law  
☐ Brother/sister-in-law ☐ Servant/other

4. What is your marital status? ☐ Unmarried ☐ Married ☐ Divorced ☐ Widowed

5. What is your education level? \_\_\_\_\_

6. What is your primary occupation? \_\_\_\_\_

a. What is your income from your primary occupation? \_\_\_\_\_

7. What is your secondary occupation? \_\_\_\_\_

a. What is your income from your secondary occupation? \_\_\_\_\_

8. Now I would like to know about the other members of your household.

Gender	Age	Relationship to head of household	Marital status	Level of education completed	Enrolled in school?




9. How much did you spend on tuition in the past year for all children? \_\_\_\_\_

a. Are school lunches provided? ☐ Yes ☐ No

10. Does your home have electricity? ☐ Yes ☐ No

11. Does your home have piped water? ☐ Yes ☐ No

12. What is your main source of drinking water?

☐ Piped water ☐ Rain water ☐ Spring water ☐ River water ☐ Shallow well

☐ Borewell ☐ Pond ☐ Vendor/tanker/bottled ☐ Other: \_\_\_\_\_

13. How long does it take to travel to water source (number of hours/minutes)? \_\_\_\_\_

14. How many jerry cans of water do you use per day? \_\_\_\_\_

15. Do you have access to roads? ☐ Yes ☐ No

16. What type of toilet facility do household members use?

☐ Pit latrine ☐ Neighbour's latrine ☐ Field/yard (no toilet)

☐ River/ditch (no toilet) ☐ Other: \_\_\_\_\_

17. Not including the bathroom, how many rooms does your home have?

☐ 1-2 ☐ 3-4 ☐ 5+

18. Which of the following statements best describes your house?

☐ Owned (with land title) ☐ Owned (without land title) ☐ Rented

☐ Other: \_\_\_\_\_

19. Do you think your house is at risk because of location or construction type?

☐ Yes ☐ No ☐ Don't know

*If yes, why?*

20. Has your house ever been flooded? ☐ Yes ☐ No ☐ Don't know

21. Have you improved the construction of your house? ☐ Yes ☐ No ☐ Don't know
- a. If yes, when did you improve the construction of your house? \_\_\_\_\_
- b. How did you improve the construction of your house? \_\_\_\_\_

22. Does your household cultivate? ☐ Yes ☐ No

- a. How many acres did you plant (i) in the first rains of 2012? \_\_\_\_\_  
(ii) in the second rains of 2012? \_\_\_\_\_
- b. Have you ever lost any crop due to droughts?  
☐ Yes ☐ No ☐ Don't know
- i. If yes, when did this happen (most recent occurrence)? \_\_\_\_\_
- ii. Which crop(s) was lost? \_\_\_\_\_
- c. Have you ever lost any crop due to floods?  
☐ Yes ☐ No ☐ Don't know
- i. If yes, when did this happen (most recent occurrence)? \_\_\_\_\_
- ii. Which crop(s) was lost? \_\_\_\_\_
- d. Does your household have a homestead garden? ☐ Yes ☐ No ☐ Don't know
- e. Where do you buy tree seedling?  
☐ In town/market ☐ In the village ☐ I do not have access
- f. Have you ever received information to know when to start planting during the year?  
☐ Yes ☐ No ☐ Don't know
- i. If yes, who informed you when to start planting?  
☐ Government ☐ Red Cross ☐ Religious groups  
☐ Community members/organizations ☐ NGOs/Civil service org.
- ☐ Other: \_\_\_\_\_
- ii. Did you use this information? ☐ Yes ☐ No

*If no, why not?*

23. What livestock do you currently own and how many of each do you own?

- a. Cows/cattle \_\_\_\_\_
- b. Goats/sheep \_\_\_\_\_
- c. Pigs \_\_\_\_\_
- d. Chickens, turkeys, and ducks \_\_\_\_\_

24. Does your household own any of the following?

☐ Radio ☐ TV ☐ Clock/watch ☐ Axe ☐ Mobile phone ☐ Bicycle ☐ Sewing machine ☐ Jewelry ☐ Car  
☐ Motorbike ☐ Refrigerator

25. What type of cooking fuel do you use?

- ☐ Gas ☐ Solar ☐ Charcoal ☐ Biogas ☐ Firewood ☐ Paraffin  
☐ Electricity ☐ Don't cook

26. Does your household have any sources of non-farm income? ☐ Yes ☐ No

27. What is your household's most important income source?

- ☐ Agriculture ☐ Salaried employment ☐ Business ☐ Biogas

☐ Other: \_\_\_\_\_

28. To whom do you sell your agricultural products?

- ☐ We don't sell ☐ Family, friends, and neighbours ☐ In the market

☐ Micro-credit group ☐ Other: \_\_\_\_\_

29. To whom do you sell livestock products?

- ☐ We don't sell ☐ Family, friends, and neighbours ☐ In the market

☐ Micro-credit group ☐ Other: \_\_\_\_\_

30. Are any members of your household disabled? ☐ Yes ☐ No

31. How much have you spent on health during the past year?

- a. Clinic visits: \_\_\_\_\_  
b. Community health worker care: \_\_\_\_\_  
c. Traditional care or medicines: \_\_\_\_\_  
d. Village health team: \_\_\_\_\_

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**READ ALOUD:** Now I would like to ask you some questions about disasters in your community.

32. How much of a concern are natural disasters to you?

- ☐ Great concern ☐ Little concern ☐ No concern

33. What types of natural disasters threaten your community? (**DO NOT READ RESPONSES ALOUD**)

- ☐ Rains ☐ Severe storms ☐ Floods ☐ Tropical cyclone/hurricane  
☐ Extreme temperature ☐ Drought ☐ Fires ☐ Earthquake

☐ High waves/swells ☐ Landslides ☐ Other: \_\_\_\_\_

☐ None ☐ Don't know

34. Could your community experience a natural disaster in the next 5 years?

- ☐ Yes ☐ No ☐ Don't know

35. Do you know the term 'climate change'? ☐ Yes ☐ No

36. How has temperature changed over the past 5 years?

- ☐ Increased ☐ Decreased ☐ No change

37. How has rainfall changed over the past 5 years? ☐ Increased ☐ Decreased ☐ No change

38. How has onset of the wet season changed over the past 5 years?

☐ Early   ☐ Late   ☐ On time

39. Are disasters becoming more common or less common?

☐ More common   ☐ Less common   ☐ No change   ☐ Don't know

40. Has your *community* been affected by natural disasters in the last 5 years? ☐ Yes   ☐ No

a. How many natural disasters have occurred in this time? \_\_\_\_\_

b. What types of disasters? **(DO NOT READ RESPONSES ALOUD)**

☐ Rains   ☐ Severe storms   ☐ Floods   ☐ Tropical cyclone/hurricane  
☐ Extreme temperature   ☐ Drought   ☐ Fires   ☐ Earthquake  
☐ High waves/swells   ☐ Landslides

☐ Other: \_\_\_\_\_

41. Has your *family* been affected by a disaster in the past 5 years? ☐ Yes   ☐ No

a. If yes, which disaster? **(DO NOT READ RESPONSES ALOUD)**

☐ Rains   ☐ Severe storms   ☐ Floods   ☐ Tropical cyclone/hurricane  
☐ Extreme temperature   ☐ Drought   ☐ Fires   ☐ Earthquake  
☐ High waves/swells   ☐ Landslides

☐ Other: \_\_\_\_\_

b. When did it happen (year and season or date)? \_\_\_\_\_

c. Did you or your family members experience any of the following?

☐ Evacuation   ☐ Serious injury (required medical attention)   ☐ Death  
☐ Minor injury (did not seek medical attention)   ☐ Property damage  
☐ Loss of business or livelihood activity

☐ Other: \_\_\_\_\_

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**READ ALOUD:** Now I would like to ask you some questions about being prepared for disasters.

42. Will being prepared help your family in an emergency situation?

☐ Yes   ☐ No   ☐ Don't know

43. How prepared is your family to handle a disaster?

☐ Very prepared   ☐ Somewhat prepared   ☐ Not prepared   ☐ Don't know

44. Compared to a year ago, is your family more or less able to handle a disaster?

☐ More able   ☐ No change   ☐ Less able   ☐ Don't know

a. If less able, why are you less able to handle a disaster? **(DO NOT READ RESPONSES ALOUD)**

☐ Lost job or income source  
☐ Reduced earnings (same job/income earning activities)  
☐ Family member died or moved away (includes resulting loss of income)  
☐ Family member became sick, disabled, or couldn't work for health reasons  
☐ Family is worst off financially than before because cost of living has increased  
☐ Other:

45. Which of the following statements best describes your family?

- ☐ We have not done anything to prepare for a disaster and we do not plan to
- ☐ We have not done anything to prepare for a disaster but we plan to in the coming months
- ☐ We just recently began preparing for a disaster
- ☐ We are prepared for a disaster

46. Do you have supplies or other things in your home that can be used in the case of a disaster? ☐ Yes ☐ No  
☐ Don't know

a. If yes, what supplies do you have? **(DO NOT READ RESPONSES ALOUD)**

- ☐ Packaged food ☐ First aid kit ☐ Eyeglasses or medicine ☐ Cash
- ☐ Bottled water ☐ Flashlight ☐ Important documents ☐ Radio
- ☐ Nothing ☐ Other:

47. Have you and your family members ever spoken about or planned what you would do if a disaster occurs? ☐ Yes ☐ No ☐ Don't know

a. If yes, what did you discuss? **(DO NOT READ RESPONSES ALOUD)**

- ☐ Planned meeting place for family members
- ☐ List of important phone numbers or contacts
- ☐ Activities to strengthen your home or reduce risk or damage to your property
- ☐ A planned list of items to bring with you in case you have to leave in a hurry
- ☐ Evacuation
- ☐ Going to a shelter/place to stay
- ☐ Nothing
- ☐ Other:

48. In the past year, have you or your family done any of the following?

a. Attended a meeting on how to be better prepared for a disaster?

- ☐ Yes ☐ No ☐ Don't know

i. If yes, who conducted the meeting? \_\_\_\_\_

b. Attended a First Aid training? ☐ Yes ☐ No ☐ Don't know

i. If yes, who conducted the training? \_\_\_\_\_

c. Participated in a disaster or evacuation drill? ☐ Yes ☐ No ☐ Don't know

i. If yes, who conducted the drill? \_\_\_\_\_

d. Participated in a community or volunteer activity related to disaster preparedness or prevention? ☐ Yes

- ☐ No ☐ Don't know

i. If yes, who conducted the activity? \_\_\_\_\_

49. Have you ever received information about rainfall that might come in the next few months or days? ☐ Yes ☐ No ☐ Don't know

a. If yes, who informed you?

- ☐ Government ☐ Red Cross ☐ Religious groups ☐ My family
- ☐ Community members/organizations ☐ NGOs/Civil service org.
- ☐ Media (radio/TV/newspaper) ☐ Nobody/no organization

☐ Other: \_\_\_\_\_

b. Did you do anything when you received that rainfall forecast?

- ☐ Yes ☐ No ☐ Don't know

ii. If yes, what did you do?

iii. If no, why didn't you do anything?

50. In the past 6 months, have you received information on disasters from any of the following sources?

- a. A person visited your home to talk about disasters ☐ Yes ☐ No ☐ Don't know
- b. Received a pamphlet or flyer ☐ Yes ☐ No ☐ Don't know
- c. Television, radio, newspaper, internet, or other media source  
☐ Yes ☐ No ☐ Don't know
- d. A community leader ☐ Yes ☐ No ☐ Don't know
- e. Government source ☐ Yes ☐ No ☐ Don't know
- f. Other source, such as community or religious groups, classmates, friends, or neighbours  
☐ Yes ☐ No ☐ Don't know

51. Does your community have a committee or organized group that decides what to do in disasters or emergencies? ☐ Yes ☐ No ☐ Don't know

52. Does your community have a disaster plan? ☐ Yes ☐ No ☐ Don't know

53. Does your community have an early warning system? ☐ Yes ☐ No ☐ Don't know

54. Does your community have evacuation routes? ☐ Yes ☐ No ☐ Don't know

55. Does your community have a shelter identified where people can go in the event of a disaster? ☐ Yes ☐ No  
☐ Don't know

56. Have community members been trained to assist others in the event of a disaster?  
☐ Yes ☐ No ☐ Don't know

57. Are your community members involved in planning or coordinating with the local government? ☐ Yes ☐ No  
☐ Don't know

58. In the past year, has the government been involved in any projects or activities related to reducing risk or vulnerability in the event of disaster in your community?  
☐ Yes ☐ No ☐ Don't know

59. Can your community access government resources or programs for disaster response and/or recovery? ☐ Yes  
☐ No ☐ Don't know

60. In the event of a disaster, what people or organizations do you have confidence in to respond and provide assistance? **(DO NOT READ RESPONSES ALOUD)**

- ☐ Government ☐ Red Cross ☐ Religious groups ☐ My family
- ☐ Community members/organizations ☐ NGOs/Civil service org.
- ☐ Media (radio/TV/newspaper) ☐ Nobody/no organization

☐ Other: \_\_\_\_\_

61. Have you lost anything due to a flood in the past? ☐ Yes ☐ No ☐ Don't know

- a. If yes, when did that flood happen? \_\_\_\_\_
- b. Describe the flood (i.e. water level) \_\_\_\_\_

- c. Were crops lost? ☐ Yes ☐ No ☐ Don't know
- d. Was your house damaged? ☐ Yes ☐ No
- i. Describe the damages to your house:
- e. Did you lose livestock? ☐ Yes ☐ No
- i. If yes, which livestock and how many?
- ☐ Cattle: \_\_\_\_\_ ☐ Goat/sheep: \_\_\_\_\_
- ☐ Pigs: \_\_\_\_\_ ☐ Chicken/turkeys/ducks: \_\_\_\_\_
- f. Did you lose stored food? ☐ Yes ☐ No
- g. What other assets did you lose?

62. Have you ever had to rebuild your home or any part of your home because of a disaster?

☐ Yes ☐ No

a. If yes, how did you pay for this?

☐ Loan ☐ Community assistance ☐ Family income ☐ Savings

☐ Other:

63. Has anyone in your household lost their lives due to a disaster in the past year?

☐ Yes ☐ No

64. Has anyone in your household ever lost their lives due to a disaster? ☐ Yes ☐ No

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**READ ALOUD:** This is the end of the interview. Thank you for taking the time to speak with me. This information will be very important for your community.

65. Can we return to your household for any follow-up questions at a later date?

☐ Yes ☐ No

66. Before I go, do you have any questions about the survey or the Red Cross or is there anything else that you think I should know?

---

**TO BE FILLED OUT BY INTERVIEWER. Wait until end of interview before completing this section.**

67.

General Sanitary Conditions	Yes	No	Don't know
House surrounded by human/animal waste			

House surrounded by piles of rubbish			
House surround by stagnant water			
House has kitchen outside			
Cooking room and sleeping room are the same			
Yard is well-maintained			

68. Main flooring type: ☐ Tiles ☐ Mud ☐ Mud with DPC ☐ Cement/bricks

☐ Other: \_\_\_\_\_

69. Main material for outer wall: ☐ Cement ☐ Mud ☐ Burnt bricks ☐ Lumber/board

☐ Other: \_\_\_\_\_

70. Main roofing type: ☐ Thatched roof ☐ Tarpaulin ☐ Cement/slate ☐ Iron sheets

☐ Other: \_\_\_\_\_



## Appendix 2 – Historical Data Questionnaire

Date:

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### READ CONSENT SCRIPT

Do you agree to be interviewed? ☐ Yes ☐ No

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Village:

Gender:

Zone/Community:

Age:

No.	Type of hazard	Year of Occurrence	Describe hazard (i.e. water level)	No. houses in village	No. houses affected	No. crop fields in village	No. crop fields damaged	Other related damages (i.e. infrastructure, disease, etc)	Community response actions	Success of community response


## Appendix 3 – Focus Group Consultation Questions

1. How have floods affected your community in the past?
2. How has your community responded to those floods?
  - a. How successful were these responses? Why?
3. What do people do when their crops fail?
4. What resources are available in your community for flood response?
  - a. Where and how did you obtain these resources?
5. Do you have a disaster committee within your community?
  - a. If yes, what is the committee's role and how does it function? How are decisions made?
  - b. If no, how do you manage floods? Who is responsible for disaster coordination in your community?
  - c. Do you have a local disaster plan? If yes, how was this plan made and who was involved in the planning process?
6. Has the government been involved in your area (not limited to disaster management)?
  - a. If yes, how has the government been involved? How do you interact with the government?
  - b. How have they been involved in disaster management, specifically?
7. What are the roles of different agencies in flood risk management and response?
  - a. What is your relationship with these agencies?
  - b. How do you interact with them?
  - c. How do they make and implement decisions? Are you involved in their decision-making process?
8. Have you ever received early warnings about floods from any of these agencies?
  - a. If yes, what did you do with the information received? Did you benefit from this information? How?
  - b. If no, why did you not utilize the information?
  - c. Do you have a flood contingency plan? If so, when was it developed? How was this plan made and who was involved in the planning process?
9. How can flood risk be reduced in your community? How can disaster-preparedness with regards to floods be increased in the long-term to minimize losses? How can the Red Cross help?
10. Have you heard about early warning systems? How about community-based early warning systems?
11. Do you think you would have benefited had early warning systems been in place in the past?
  - a. If yes, how?
  - b. If not, why not?
12. What are your traditional methods of forecasting floods? Who is responsible for producing these forecasts? And how are they disseminated to communities?
13. Do you think it is feasible to implement an early warning system in your community? How can this system be tailored to suit your needs? What kinds of community resources can you provide to monitor risk, receive and disseminate warnings, and coordinate flood response?
14. What kinds of emergency relief do you require before a flood? During? After?

## **Appendix 4 – Semi-structured Interview Questions for ZRC Staff**

1. What are the goals of forecast-based decision making?
2. How does the Zambian Red Cross National Society integrate forecasts into decision-making?
3. Where do you receive forecasts from? How do you disseminate this information?
4. How do you determine whether or not a community is vulnerable to a particular climate risk?
5. What is your relationship with vulnerable communities? How do you interact with community members?
6. How successful do you think forecast-based decision making has been?
7. How do you decide what actions need to be taken in the event of a flood?
8. How do you take action? What is the communication chain when disseminating forecast information and decisions? Who has ultimate disaster related decision-making authority within the Zambian Red Cross?
9. How have you responded to floods in the past? Were your actions successful?
10. What relief items do you distribute? Who supplies them and where are they stored?
11. Do you have a source from which you can acquire funds from rapidly once a disaster strikes?
12. How much certainty is enough certainty to warrant taking anticipatory action? What determines when is a good time to act?
13. What are the challenges of implementing forecast-based decisions?
14. Where do you see room for improvement? Has the integration of forecasts into decision-making improved over the past few years? Why and how? Or why not and how not?

## Appendix 5 – Codebook

1. What future is valued in each of the communities – goals, desires, hopes expressed by individuals. (FUTURE)
2. Indications of sensitivities to floods (SENSITIVITY)
  - a. Wealth/poverty (SENS\_WEALTH)
  - b. Education (SENS\_EDU)
  - c. Type of livelihood (SENS\_LIV)
  - d. Household construction (SENS\_HHQUAL)
  - e. Access to entitlements (SENS\_ENT)
  - f. Other (SENS\_OTHER)
3. Indications of differential sensitivities to floods (DIFFSENSITIVITY)
  - a. according to wealth (DIFFSENS\_WEALTH)
  - b. according to educational attainment (DIFFSENS\_EDU)
  - c. according to secondary livelihoods (DIFFSENS\_LIV)
  - d. according to agricultural dependency (DIFFSENS\_AGR)
  - e. according to household construction (DIFFSENS\_HHQUAL)
  - f. according to water access and availability (DIFFSENS\_WAT)
  - g. other (DIFFSENS\_OTHER)
4. Social capital (SOCIAL CAPITAL)
  - a. Roles of individuals (village headmen, community leaders, community members) (IND ROLES)
  - b. Structure and roles of communities and villages (COMMVILL ROLES)
  - c. Structure and roles of households and families (HHFAM ROLES)
5. Ecosystem services/goods provided by biophysical subsystem (ECOSERVICES)
6. Long-term effects of floods and droughts on sensitivity to floods (LONG TERM EFFECTS)
7. How have communities responded to floods in past? (HIST RESPONSE)
8. How do communities respond to floods now? (CURR RESPONSE)
9. Capacities in the community (CAPACITIES)

10. Vulnerable groups in the community (VUL GROUPS)
11. Community preparedness for floods (PREPAREDNESS)
12. Normative barriers (NORM BARRIERS)
  - a. Traditional practices in communities (TRADPRAC)
  - b. How are traditional practices affected by floods? (TRADPRAC\_AFFECT)
  - c. How do these practices exacerbate the effects of floods? (TRADPRAC\_EXACERBATE)
13. Cognitive barriers (COG BARRIERS)
  - a. Perceptions of risk and preparedness (PERC RISK PREP)
  - b. Fatalism (FATALISM)
  - c. Denial (DENIAL)
  - d. Wishful thinking (WISHFUL THINKING)
14. Political barriers (POL BARRIERS)
15. Institutional barriers (INST BARRIERS)
  - a. Role of households, individuals, and traditional leadership in disaster management (SOC ACTOR ROLES)
  - b. Role of government (GOV ROLE)
  - c. Role of RC (RC ROLE)
  - d. How do government and communities interact? (GOV COMM)
16. Human/informational barriers (INFO BARRIERS)
  - a. What kind of knowledge/information do community members think they need? (INFO)
  - b. Do they have access to that knowledge? (INFO\_ACCESS)
  - c. Do they use the knowledge they receive? (INFO\_USE)
  - d. Involvement of external organizations/agencies in promoting preparedness (ORG\_PREP)
17. Technological barriers (TECH BARRIERS)
18. Economic barriers (ECON BARRIERS)
19. Natural/physical barriers/limits (NATURAL BARRIERS)

## Appendix 6 – Historical Flood Profiles

The ‘related damages’ and ‘range of community responses’ columns do not necessarily represent the full range of experiences of community members; rather, they are representative of what interviewed members experienced. The ‘range of community responses’ column does not indicate how every community member responded to a hazard – many community members during each disaster took no action, or took different actions (that were not stated to us).

### Kasaya Historical Profile

Year	Flood Description	Damages	Range of community responses
1958	Water level was high	<ul style="list-style-type: none"> <li>• Crops fields damaged</li> <li>• Animal disease outbreaks</li> <li>• Bridges destroyed</li> </ul>	<ul style="list-style-type: none"> <li>• No response</li> <li>• Used boats for survival</li> </ul>
1959	Water was 8.25 m from the banks	<ul style="list-style-type: none"> <li>• Crop failure</li> <li>• CBPP</li> <li>• Ringworms</li> <li>• FMD</li> <li>• Diarrhea</li> <li>• Malaria</li> <li>• Measles</li> <li>• Scabies</li> </ul>	<ul style="list-style-type: none"> <li>• No response</li> <li>• Shifted to upper land</li> </ul>
1978	Water level was high	<ul style="list-style-type: none"> <li>• Malaria</li> <li>• Diarrhea</li> <li>• Houses damaged</li> <li>• Crop failure</li> </ul>	<ul style="list-style-type: none"> <li>• No response</li> <li>• Shifted to upper land</li> </ul>
1988	Water level was high, some estimated it to be 1.3 m in their fields	<ul style="list-style-type: none"> <li>• Diarrhea</li> <li>• Vomiting</li> <li>• Homes submerged/destroyed</li> <li>• Fields damaged</li> <li>• Measles</li> <li>• CBPP</li> <li>• Malaria</li> </ul>	<ul style="list-style-type: none"> <li>• No response</li> <li>• Shifted to upper land</li> <li>• CARE and PUSH distributed food</li> </ul>
2000	Water level was high, some estimated it to be 1.3 m in their fields	<ul style="list-style-type: none"> <li>• Houses collapses</li> <li>• Crop failure</li> </ul>	<ul style="list-style-type: none"> <li>• No response</li> <li>• Collapsed structures were rebuilt</li> </ul>
2006	Water level was high,	<ul style="list-style-type: none"> <li>• Fields damaged</li> </ul>	<ul style="list-style-type: none"> <li>• No response</li> </ul>

	some estimated it to be up to 1.3 m in their fields	<ul style="list-style-type: none"> <li>• Crop failure</li> <li>• CBPP</li> <li>• Ringworms</li> <li>• FMD</li> <li>• Malaria (poor response from clinics)</li> <li>• Houses damaged</li> <li>• Household belongings lost (clothing, cooking utensils)</li> </ul>	<ul style="list-style-type: none"> <li>• Shifted to upper land</li> <li>• Evacuation to Kazungula conducted by headmen and government</li> <li>• Rebuilt homes</li> </ul>
2008	Water level was high, some estimated it to be up to 1.2 m in their fields	<ul style="list-style-type: none"> <li>• Crop failure</li> <li>• Hunger</li> <li>• CBPP</li> <li>• Malaria</li> <li>• Diarrhea</li> <li>• Chicken pox</li> <li>• FMD</li> <li>• Houses damaged</li> </ul>	<ul style="list-style-type: none"> <li>• No response</li> <li>• Shifted to upper land</li> <li>• Requested government support – government conducted part of the evacuation</li> <li>• Rebuilt homes</li> </ul>
2012	Water level was high, some estimated it to be up to knee high in their fields	<ul style="list-style-type: none"> <li>• Fields damaged</li> <li>• Household goods damaged</li> <li>• Livestock disease outbreak</li> <li>• Livestock death</li> <li>• Houses damaged</li> </ul>	<ul style="list-style-type: none"> <li>• No response</li> <li>• Shifted to upper land</li> <li>• Rebuilt homes</li> </ul>
2013	Water level was high	<ul style="list-style-type: none"> <li>• Crop failure</li> <li>• Houses damaged</li> </ul>	<ul style="list-style-type: none"> <li>• No response</li> <li>• Shifted to upper land</li> </ul>

## Sikaunzwe Historical Profile

Year	Flood Description	Damages	Range of community responses
1942	Water level was high		
1948	Water level was high	<ul style="list-style-type: none"> <li>• Broke bridge</li> <li>• Destroyed all fields</li> </ul>	<ul style="list-style-type: none"> <li>• Headmen given food by government</li> </ul>
1952	Water level was high	<ul style="list-style-type: none"> <li>• People could not find food</li> </ul>	
1958	Water level was high	<ul style="list-style-type: none"> <li>• Disease outbreak</li> <li>• Mass livestock death</li> </ul>	
1964	Water level waist high	<ul style="list-style-type: none"> <li>• Damages were vast</li> </ul>	
1995	Water level was high, some estimated it to be	<ul style="list-style-type: none"> <li>• Fields submerged</li> <li>• Crop failure</li> </ul>	<ul style="list-style-type: none"> <li>• No response</li> <li>• Turned to alternative</li> </ul>



	up to 1 m high in their fields	<ul style="list-style-type: none"> <li>Human disease outbreaks</li> <li>Livestock disease outbreaks</li> <li>Infrastructural damage</li> </ul>	livelihoods i.e. charcoal burning
2001	Water level was high, some estimated it to be up to 1 m high in their fields	<ul style="list-style-type: none"> <li>Livestock disease outbreaks</li> <li>Poverty</li> <li>Crop failure</li> </ul>	<ul style="list-style-type: none"> <li>No response</li> <li>Turned to alternative livelihoods</li> </ul>
2004		<ul style="list-style-type: none"> <li>Roads submerged</li> <li>Crop failure</li> </ul>	
2006	Water level was high, some estimated it to be up to 1.5 m in their fields. Levels were so high that anthills on the plains were submerged. The water was moving very fast.	<ul style="list-style-type: none"> <li>Crop failure</li> <li>Mass livestock deaths</li> <li>Human death</li> <li>Livestock disease outbreaks (CBPP)</li> <li>Food shortages/hunger</li> <li>Water borne disease outbreaks (i.e. typhoid)</li> <li>Malaria</li> <li>Diarrhea</li> <li>Children unable to attend school</li> <li>Domestic disputes due to hardships</li> <li>Pit latrines damaged</li> <li>Homes damaged</li> </ul>	<ul style="list-style-type: none"> <li>No response</li> <li>Sold livestock for income and to prevent further spread of livestock diseases</li> <li>Shifted to upper lands</li> <li>Turned to alternative livelihoods i.e. charcoal burning, small-scale business</li> <li>Applied for government assistance</li> </ul>
2007	Water level was high, some estimated it to be up to knee high in their fields.	<ul style="list-style-type: none"> <li>Crop failure</li> <li>CBPP</li> <li>Flu (chicken and pigs)</li> <li>Cough (pigs)</li> </ul>	No response
2012	Water level was high	<ul style="list-style-type: none"> <li>Crop failure</li> <li>Contaminated water</li> </ul>	No response
2013	Water level was high, some estimated it to be up to chest high in their fields	<ul style="list-style-type: none"> <li>Crop failure</li> <li>Grazing pastures damaged</li> <li>Livestock disease outbreaks (i.e. CBPP in cattle, 'lamp skin' in goats)</li> <li>Malaria</li> <li>Homes damaged</li> </ul>	<ul style="list-style-type: none"> <li>No response</li> <li>Contacted District Commissioner to assess situation, but he was unable to come as the roads were submerged</li> <li>Dug furrows/drainages and dams around fields</li> <li>Made ledges to obstruct water</li> <li>Bought medicines to treat livestock</li> </ul>

			<ul style="list-style-type: none"> <li>Shifted to upper land</li> </ul>
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## Sikuzu Historical Profile

Year	Flood Description	Damages	Range of community responses
1937	Water level was high, some estimated it to be up to ankle high in their fields	<ul style="list-style-type: none"> <li>Crop failure</li> <li>Measles</li> <li>Malaria</li> </ul>	<ul style="list-style-type: none"> <li>No response</li> <li>Turned to alternative livelihoods i.e. gardening and making mats using reeds</li> </ul>
1942	Water level was high, some estimated it to be up to shoulder high in their fields	<ul style="list-style-type: none"> <li>Crop failure</li> <li>Starvation</li> </ul>	No response
1948	Water level was high, some estimated it to be up to waist high in their fields.	<ul style="list-style-type: none"> <li>Households damaged</li> <li>Crop failure</li> <li>Human death</li> <li>Malaria</li> </ul>	No response
1949	Water level was high, some estimated it to be up to shoulder high in their fields.	<ul style="list-style-type: none"> <li>Crop failure</li> <li>Livestock death</li> <li>Livestock disease outbreaks</li> <li>Malaria</li> <li>Water borne disease outbreaks</li> <li>Diarrhea</li> </ul>	<ul style="list-style-type: none"> <li>No response</li> <li>Turned to alternative livelihoods, i.e. gardening</li> <li>People were evacuated</li> <li>Shifted to upper land</li> <li>Applied to for government aid</li> </ul>
1958	Water level was high, some estimated it to be up to shoulder high in their fields.	<ul style="list-style-type: none"> <li>Crop failure</li> <li>Fields damaged</li> <li>Gardens damaged</li> <li>Livestock disease outbreaks</li> <li>Livestock death</li> <li>Malaria</li> <li>Cholera</li> <li>Diarrhea</li> </ul>	<ul style="list-style-type: none"> <li>No response</li> <li>People were evacuated</li> <li>Turned to alternative livelihoods i.e. gardening, selling cut reeds</li> <li>NGOs provided some aid</li> </ul>
1959	Water level was high, some estimated it to be up to ankle high in their fields.	<ul style="list-style-type: none"> <li>Crop failure</li> <li>Malaria</li> <li>Cholera</li> </ul>	No response
1968	Water level was high, some estimated it to be up to waist high in their fields.	<ul style="list-style-type: none"> <li>Crop failure (especially sweet potato)</li> <li>Reptiles ate chicken</li> </ul>	<ul style="list-style-type: none"> <li>No response</li> <li>Shifted to upper land</li> <li>Turned to alternative livelihoods i.e. making mats using reeds</li> </ul>

1978	Water level was high, some estimated it to be up to shoulder high in their fields	<ul style="list-style-type: none"> <li>• Crop failure (especially maize)</li> <li>• Gardens damaged</li> <li>• Malaria</li> <li>• Livestock disease outbreaks</li> </ul>	<ul style="list-style-type: none"> <li>• No response</li> <li>• Turned to alternative livelihoods i.e. fishing</li> <li>• People were evacuated</li> </ul>
1982	Water level was high, some estimated it to be up to knee high in their fields.	<ul style="list-style-type: none"> <li>• Crop failure</li> </ul>	<ul style="list-style-type: none"> <li>• No response</li> <li>• Received aid from the government</li> </ul>
1988	Water level was high, some estimated it to be up to shoulder high in their fields.	<ul style="list-style-type: none"> <li>• Fields destroyed (especially maize)</li> <li>• Hunger</li> <li>• Livestock disease outbreaks (i.e. foot and mouth disease)</li> </ul>	<ul style="list-style-type: none"> <li>• No response</li> <li>• Receive aid from government</li> </ul>
1989	Water level was high, some estimated it to be up to knee high in their fields.	<ul style="list-style-type: none"> <li>• Crop failure</li> <li>• Soil was waterlogged</li> <li>• Soil erosion</li> </ul>	<ul style="list-style-type: none"> <li>• Turned to alternative livelihoods i.e. fishing</li> </ul>
1990	Water was 7 m from the banks	<ul style="list-style-type: none"> <li>• Crop failure</li> <li>• Soil erosion</li> </ul>	<ul style="list-style-type: none"> <li>• Turned to alternative livelihoods i.e. making mats using reeds (but there was no market or demand for the goods)</li> </ul>
1998	Water level was high, some estimated it to be up to waist high in their fields.		
2001	Water level was high	<ul style="list-style-type: none"> <li>• Soil erosion</li> </ul>	<ul style="list-style-type: none"> <li>• Turned to alternative livelihood i.e. selling cut reeds</li> </ul>
2004	Water level was high, some estimated it to be up to waist high in their fields.	<ul style="list-style-type: none"> <li>• Crop failure (especially sweet potato)</li> </ul>	<ul style="list-style-type: none"> <li>• Shifted to upper land</li> </ul>
2005	Water was 6.5 m from the banks	<ul style="list-style-type: none"> <li>• Crop failure</li> <li>• Reptiles ate chickens, pigs and goats</li> </ul>	<ul style="list-style-type: none"> <li>• Turned to alternative livelihoods i.e. making mats using reeds, fishing</li> </ul>
2006	Water level was high, some estimated it to be up to chest high in their fields.	<ul style="list-style-type: none"> <li>• Crop failure</li> </ul>	<ul style="list-style-type: none"> <li>• Shifted to upper land</li> </ul>
2007	Water level was high, some estimated it to be up to ankle high in their fields.	<ul style="list-style-type: none"> <li>• Crop failure</li> <li>• Soil erosion</li> </ul>	<ul style="list-style-type: none"> <li>• Turned to alternative livelihoods i.e. selling cut reeds</li> </ul>
2008	Water level was high,	<ul style="list-style-type: none"> <li>• Crop failure</li> </ul>	<ul style="list-style-type: none"> <li>• People were evacuated</li> </ul>

	some estimated it to be up to waist high in their fields.	<ul style="list-style-type: none"> <li>• Hippos entered villages</li> <li>• Water borne disease outbreaks</li> <li>• Malaria</li> </ul>	<ul style="list-style-type: none"> <li>• Turned to alternative livelihoods i.e. selling cut reeds, making mats using reeds</li> </ul>
2010	Water level was high, some estimated it to be up to knee high in their fields.	<ul style="list-style-type: none"> <li>• Crop failure</li> <li>• Gardens destroyed</li> </ul>	
2011	Water level was high, some estimated it to be up to waist high in their fields.	<ul style="list-style-type: none"> <li>• Crop failure</li> <li>• Soil erosion</li> <li>• Grazing pastures affected</li> <li>• Livestock affected</li> <li>• Water borne disease outbreak</li> <li>• Malaria</li> </ul>	<ul style="list-style-type: none"> <li>• People were evacuated</li> <li>• Shifted to upper land</li> <li>• Turned to alternative livelihoods i.e. gardening, making mats using reeds, fishing,</li> </ul>
2012	Water was 6.0 m from the banks, water was moving very fast	<ul style="list-style-type: none"> <li>• Crop failure (especially maize)</li> <li>• Fields damaged</li> <li>• Gardens damaged</li> <li>• Mass livestock death</li> <li>• Reptiles ate chickens</li> <li>• Hippos destroyed gardens and fields</li> <li>• Soil erosion</li> <li>• Malaria</li> </ul>	<ul style="list-style-type: none"> <li>• Community leaders and CARE responded</li> <li>• Conducted community meetings</li> <li>• Sent report to agriculture office</li> <li>• Turned to alternative livelihoods i.e. gardening, making mats using reeds, selling fish in the market</li> </ul>
2013	Water level was high, some estimated it to be up to knee high in their fields.	<ul style="list-style-type: none"> <li>• Crop failure</li> <li>• Malaria</li> </ul>	

## Situlu Historical Profile

Year	Flood Description	Damages	Range of community responses
1940	Water level was high	<ul style="list-style-type: none"> <li>• Crop failure</li> <li>• Livestock disease outbreak</li> <li>• Malaria</li> </ul>	<ul style="list-style-type: none"> <li>• Shifted to upper land</li> <li>• Found other places to plough</li> <li>• Had to search for food</li> </ul>
1948	Water level was high	<ul style="list-style-type: none"> <li>• Crop failure</li> <li>• Livestock disease outbreaks</li> <li>• Malaria</li> </ul>	<ul style="list-style-type: none"> <li>• Shifted to upper land</li> <li>• Found other places to plough</li> <li>• Had to search for food</li> </ul>
1953	Water level was high, some estimated it to be up to thigh high in	<ul style="list-style-type: none"> <li>• Crop failure</li> <li>• Livestock disease</li> </ul>	<ul style="list-style-type: none"> <li>• Asked community members in the upper</li> </ul>

	their fields.	<ul style="list-style-type: none"> <li>• outbreak</li> <li>• Grazing pastures damaged</li> </ul>	lands for help
1958	Water level was high, some estimated it to be up to shoulder high in their fields.	<ul style="list-style-type: none"> <li>• Houses collapsed</li> <li>• Crop failure</li> <li>• Crop fields submerged</li> <li>• Malaria</li> <li>• Malnutrition</li> <li>• Livestock disease outbreak</li> </ul>	<ul style="list-style-type: none"> <li>• Dug ridges to obstruct flood waters</li> <li>• People shifted (with their livestock) to upper lands</li> <li>• Farmed on anthills</li> <li>• Turned to alternative livelihoods i.e. selling cut grass</li> <li>• Found other places to plough</li> <li>• Had to search for food</li> <li>• Stored food so that it couldn't be destroyed by water or pests</li> </ul>
1968	Water level was high, some estimated it to be up to waist high in their fields.	<ul style="list-style-type: none"> <li>• Crop failure</li> <li>• Grazing pastures affected</li> <li>• Houses collapsed</li> <li>• Malnutrition</li> </ul>	<ul style="list-style-type: none"> <li>• Dug ridges to obstruct flood waters</li> <li>• Dug furrows to drain flood waters</li> <li>• Shifted cattle to upper lands for pastures</li> <li>• People shifted temporarily to anthills for shelter</li> </ul>
1972	Water level was high, water was moving very fast	<ul style="list-style-type: none"> <li>• Livestock diseases (foot and mouth)</li> <li>• Crop failure</li> <li>• Children unable to go to school</li> </ul>	
1974	Water level was high	<ul style="list-style-type: none"> <li>• Crop failure</li> <li>• Livestock disease outbreak</li> <li>• Malaria</li> </ul>	<ul style="list-style-type: none"> <li>• Shifted to upper land</li> <li>• Found other places to plough</li> <li>• Had to search for food</li> </ul>
1975	Water level was high	<ul style="list-style-type: none"> <li>• Crop failure</li> <li>• Malaria</li> <li>• Livestock disease outbreak (foot and mouth)</li> </ul>	<ul style="list-style-type: none"> <li>• Shifted to upper land</li> </ul>
1976	Water level was high	<ul style="list-style-type: none"> <li>• Crop failure</li> <li>• Livestock disease outbreak</li> <li>• Malaria</li> </ul>	<ul style="list-style-type: none"> <li>• Shifted to upper land</li> <li>• Found other places to plough</li> <li>• Had to search for food</li> <li>• Turned to alternative livelihoods i.e. gardening</li> </ul>
1978	Water level was high, some estimated it to be	<ul style="list-style-type: none"> <li>• Crop failure</li> <li>• Starvation</li> </ul>	<ul style="list-style-type: none"> <li>• Dug furrows to drain flood waters</li> </ul>

	up to knee high in their fields.	<ul style="list-style-type: none"> <li>• Houses collapsed</li> <li>• Malaria</li> <li>• Diarrhea</li> </ul>	<ul style="list-style-type: none"> <li>• Farmed on mounds and anthills</li> <li>• Ate wild fruits</li> <li>• Ate fish</li> </ul>
1993	Water level was high	<ul style="list-style-type: none"> <li>• Crop failure</li> <li>• Malaria</li> <li>• Bilharzia</li> <li>• Children unable to go to school</li> </ul>	<ul style="list-style-type: none"> <li>• Shifted to upper land</li> </ul>
2007	Water level was high, some estimated it to be up to knee high in their fields	<ul style="list-style-type: none"> <li>• Crop failure</li> <li>• Crop disease</li> </ul>	<ul style="list-style-type: none"> <li>• Shifted to upper land</li> <li>• Turned to alternative livelihoods i.e. gardening</li> </ul>
2008	Water level was high, some estimated it to be up to waist high in their fields.	<ul style="list-style-type: none"> <li>• Crop failure</li> <li>• Houses collapsed</li> <li>• Fields submerged</li> <li>• Malaria</li> <li>• Livestock disease outbreaks (i.e. CBPP)</li> <li>• Malaria</li> <li>• Diarrhea</li> <li>• Tick borne diseases</li> </ul>	<ul style="list-style-type: none"> <li>• Shifted cattle to upper land for pastures</li> <li>• People farmed on anthills</li> <li>• Unsuccessfully tried to block flood waters</li> <li>• Sick people were rushed to the clinic</li> <li>• Made appeals to the government for food aid</li> <li>• Turned to alternative livelihoods i.e. goat rearing</li> <li>• Regular cattle vaccination against CBPP prevented cattle death</li> </ul>
2013	Water level was high, some estimated it to be up to knee high in their fields.	<ul style="list-style-type: none"> <li>• Crop failure</li> <li>• Malaria</li> <li>• Food shortages</li> <li>• Grazing pastures affected</li> </ul>	<ul style="list-style-type: none"> <li>• Shifted cattle to upper land for pastures</li> <li>• Each household received a net from the Health Department</li> <li>• Shifted cultivation from floodplain to upper land</li> </ul>